Vol. XIX No. 5

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TABLE OF CONTENTS

The Table of Contents lists in alphabetical order the principal subject headings of the dissertations abstracted. For the convenience of readers an alphabetical author index is included following the abstracts.

AGRICULTURE 919

ANATOMY 929

ANTHROPOLOGY 930

ASTRONOMY 933

BACTERIOLOGY 933

BIOLOGY - GENETICS 939

BOTANY 940

CHEMISTRY 941

ECONOMICS 973

EDUCATION 984

ENGINEERING 1031

FOOD TECHNOLOGY 1049

GEOGRAPHY 1051

GEOLOGY 1052

HEALTH SCIENCES 1058

HISTORY 1063

HOME ECONOMICS 1069

JOURNALISM 1070

LANGUAGE AND LITERATURE 1071

LIBRARY SCIENCE 1081

MATHEMATICS 1083

PHARMACOLOGY 1090

PHYSICS 1092

PHYSIOLOGY 1102
POLITICAL SCIENCE 1106
PSYCHOLOGY 1107
RELIGION 1129
SOCIAL PSYCHOLOGY 1133
SOCIOLOGY 1135
SPEECH - THEATER 1137
ZOOLOGY 1141
AUTHOR INDEX ..... following page 1147

AGRICULTURE, GENERAL

THE EFFECTS OF RESTRICTED ENERGY INTAKE ON REPRODUCTION IN GILTS

(L. C. Card No. Mic 58-3492)

Charles Edward Haines, Ph.D.
The University of Florida, 1958

This study was conducted to determine the effects of two levels of energy intake on age at puberty, ovulation rate, embryonic survival and related factors in Duroc gilts.

A total of 102 gilts, weighing approximately 123 pounds, were divided into two equal groups on the basis of weight, age and ancestry. One group received a maximum amount of a 16 per cent protein ration during the entire experiment (full-fed). The other group (limited-fed) was allowed one-half of the amount consumed by full-fed gilts. Two rations used were adjusted so that gilts in both groups received equal amounts of protein, vitamins and minerals. Gilts were maintained on pasture and bred at the second heat. One-third of the gilts on each ration were sacrificed three days after breeding, one-third 25 days postbreeding and the remainder allowed to farrow.

Limited-fed gilts gained 0.4 pound per day during the prebreeding period compared to 1.0 pound for full-fed gilts. Daily gains for both groups were higher during pregnancy but full-fed gilts continued to have significantly larger gains. Limited-feeding lowered feed efficiency during the prebreeding period but not during pregnancy.

Femininity ratings were assigned to gilts on the basis of head and face characteristics. Correlation coefficients between femininity scores and age at puberty, ovulation on pigs farrowed were non-significant. Limited-fed gilts averaged 217 days of age and 160 pounds at puberty while full-fed gilts were 22 days younger and 36 pounds heavier at this stage of development. Differences between ration treatments for age and weight at puberty were highly significant.

Rations had no effect on length of estrual cycles or on fertilization rates. Estrual cycles averaged 20 days and 96.5 per cent of the ova recovered were fertilized. Full-fed gilts ovulated 2.9 more ova at the first heat and 2.3 more ova at the second heat than limited-fed gilts but these differences were non-significant. Gilts on both rations ovulated approximately one more ova at the second heat than at the first heat.

At 25 days of gestation, limited and full-fed gilts contained 9.9 and 10.1 normal embryos, respectively. Thus, limited-fed gilts showed a 10.5 per cent greater embryonic survival rate. Limited-fed gilts farrowed 8.7 live pigs per litter compared to 9.0 pigs by full-fed gilts. Limited-fed gilts showed an 11.7 per cent higher survival rate to term them full-fed gilts. Combined rate of survival between ovulation and farrowing was 73 per cent and approximately two-thirds of the loss occurred before 25 days of pregnancy. Differences in embryonic survival rates between rations were non-significant.

Intra-uterine migration of ova occurred in over 50 per cent of the uteri examined and the number of embryos were about equal in the two uterine horns. Size of 25-day embryos was not affected by ration but pigs farrowed by limited-fed gilts were 0.19 pound lighter than those by full-fed gilts. Twenty-four of 29 gilts that farrowed exhibited postpartum heat within five days after parturition but matings were not fertile.

Gonadotrophin assays showed that gilts pregnant for 25 days had greater gonadotrophic content than gilts at three days postbreeding. Level of feeding had no effect on gonadotrophic content of pituitary glands.

The results of this study indicate that limiting the energy intake of gilts increased age at puberty and depressed growth. Restricting energy intake also decreased ovulation rates but was beneficial for prenatal survival.

Microfilm $2.15; Xerox $7.60. 164 pages.

PHOSPHOLIPID AND CASEIN INTERACTIONS IN MILK

(L. C. Card No. Mic 58-5350)

Syed Mahmoodulla Husaini, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Arthur M. Swanson

Reconstituted dry milk products often exhibit a tactual defect known as "chalkiness". Dry whole milk seems to be subject to this defect to a greater extent than nonfat dry milk. It was logically assumed that the increased phospholipid content of dry whole milk could be related to this problem. It has been demonstrated that other milk constituents such as certain whey proteins and casein interact on heating, so a study was undertaken to determine if casein and milk phospholipids would react on heating solutions containing them.

A phosphate buffer of pH 6.8 and 0.1 ionic strength was chosen as a simple system for the study of possible casein and phospholipid interactions. All the solutions of casein and phospholipids were made using this buffer and almost all the operations were carried out in a cold room kept at 5° C temperature. Phospholipids (mainly lecithins) were prepared from buttermilk powder by Roese Gottlieb and 1:1 ethanol-ethyl ether extraction methods. Either of these methods yielded the same kind of substances in all physical and chemical properties and the phospholipids were assumed to be lecithins according to the phosphorus and nitrogen analysis.

Casein was prepared by iso-electric precipitation at pH 4.8 and part of it was further fractionated into alpha-casein. In general, 3% casein and 1% phospholipid solutions were used. A small amount of thymol was added to the solutions as a preservative. Mixtures of casein and phospholipid were heated to 180° F for 15 minutes in an oil bath and then immediately cooled down to 40° F.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Methods studied to detect the complex formation (interaction) were as follows: (1) phosphorus determination of the ethyl ether extract of casein-phospholipid mixtures before and after heating, (2) nephelometry (3) changes in pH for maximum precipitation (4) viscosity (5) Tiselius electrophoresis and (6) starch gel zone electrophoresis.

The methods mentioned above were mostly qualitative in nature. Among all the six methods, the extraction method worked most satisfactorily to prove the establishment of an interaction between phospholipid and casein upon heating. The ether extraction method which was also quantitative was perhaps the most convincing. It proved that heating was essential to get an interaction between casein, alpha-casein and phospholipid. Casein and phospholipid mixtures, upon heating, were so firmly bound together that 63.07% phospholipid could not be extracted by ethyl ether. Effect of ethanol on breaking this combination was remarkable. It was possible to extract 90% of the phospholipids after the addition of ethanol. Similar results were obtained when alpha-casein was used.

Extremely small concentrations of casein and phospholipids were used when the interaction was determined by the increase in 'haze' values in the nephelometer. The method was very sensitive and slight changes in the aggregation of the suspended particles showed big changes in 'haze' values. Nephelo values were determined on mixtures of nine ratios of casein: phospholipid. Increase in 'haze' values upon heating the mixture depended on the ratio and at one particular value the nephelo value was maximum.

Casein having a sharp iso-electric point was a model protein to use for the detection of interaction with phospholipid by the method of maximum precipitation. A shift in the curve indicating relationship between Kjeldahl nitrogen and pH was observed.

Viscosity measurements by Ostwald pipette on casein-phospholipid mixtures with and without heat treatment indicated marked changes in relative viscosity values.

Electrophoretic studies, both Tiselius and starch gel zone electrophoresis did not give any information and it was found desirable to abandon this part of the studies.

After conducting the above mentioned chemical and physical studies, the complex thus formed was tested for the chalkiness after being mixed in fresh whole milk samples. Taste tests on a small scale showed that even small amounts of the complex, when mixed with milk samples, exhibited the chalky defect.

Microfilm $2.00; Xerox $4.00. 75 pages.

CONSUMERS' USE OF AND OPINIONS ABOUT FLORIDA AVOCADOS

(L. C. Card No. Mic 58-3498)

William Tanner Manley, Ph.D.
The University of Florida, 1958

The upward trend in the production of avocados in Florida has created considerable concern within the industry about whether future crops can be marketed successfully. Marketing efforts are being intensified by an attempt to increase the total market for Florida avocados through the use of various promotional activities. The major objective of this study is to provide the Florida avocado industry with information useful in the efficient implementation of an over-all promotional program.

The information presented pertains to the extent to which avocados are used and to those factors which appear related to consumer use patterns. The data were obtained by personal interview from a probability sample of families residing in the city of Dayton, Ohio. Respondents were asked to convey their familiarity with, use patterns of, and opinions about avocados. The study was designed to determine whether significant differences exist among various population groups with respect to these uses, opinions, and levels of awareness. To this end, the sample population was divided into segments by family income, race, educational level, occupation, age, and size of family.

The use pattern for avocados varies widely. Avocados had been used in the home at some time in the past by only one-third of the families included in the sample survey. Almost one-fifth were totally unfamiliar with them. The remaining proportion was about equally divided between those who knew about avocados but had never eaten one and those who had eaten them but at some place other than in the home.

The use of avocados in the home was found to be somewhat more characteristic of high income families than of families with relatively low incomes. Their use was also more prevalent in homes in which the educational level of the housewife was relatively high and the occupational status of head of household was of a professional or technical nature. Age and composition of the family, however, appeared to be unrelated to existing use patterns.

Among those who use avocados, only a small proportion are frequent users. Only 10 percent had served them at home as often as two or three times a month during the year preceding the interview. The rate at which avocados were used did not vary significantly among the various population groups.

Apparently, avocados are unavailable in a substantial number of retail food stores. Less than one-half of the respondents indicated that avocados were usually available in stores where they shopped.

A dislike for the taste of avocados appears to be the single most important reason for the infrequent rate at which they are used. The manner and occasion for using avocados also have a bearing upon the low rate at which they are consumed. Consumers are generally unfamiliar with a wide variety of ways in which avocados can be served. Also, they are served almost exclusively at mealtime and they are not regarded by consumers as a food which complements principal items on the meal menu.

The widespread nonfamiliarity with avocados and the large proportion of consumers who are nonusers seem to indicate that the immediate problem of market promotion is largely one of introduction or encouraging initial use.

Microfilm $2.85; Xerox $9.80. 217 pages.

SELECTION AND COMPARISON OF OPTIMUM ORGANIZATIONS FOR FARMS IN THE LINCOLN AREA OF SOUTHERN ILLINOIS WITH EMPHASIS ON DAIRYING

(L. C. Card No. Mic 58-5507)

Dean Fanning Tuthill, Ph.D.
University of Illinois, 1958

During the recent period following World War II and the Korean War, farmers in this country suffered declines in prices of their products and their incomes while the rest of the country enjoyed a continued high level of prosperity. The problem of declining farm incomes relative to non-farm incomes created interest in this study. The causes of the farm income decline were many and complex, but the crux of the problem was that the supply of agricultural products in the quantity and composition which existed could not move into consumption at market prices which would provide farm incomes equivalent to non-farm incomes. The solution to the problem, again complex and illusive, was approached from the standpoint of good farm management. That is, relative prices for products should guide the farmer's use of his resources so that the quantity, and especially the composition of his products would be adjusted to what the consumer market would be able to absorb at prices sufficient to give the farmers an adequate and equitable income. The objectives of the study were to develop, analyze and compare optimum farm organizations for a particular agricultural area under typical resources and crop and livestock enterprises. Particular attention was given to the place of dairying in the use of resources.

The Lincoln area, a band of twelve counties extending east from St. Louis across the width of Illinois, was selected for particular study. This area was chosen because it had poorer natural resources than central and northern Illinois, and yet a fairly wide range of crop and livestock enterprise alternatives existed. Farmers experienced difficulties in adjusting to declining prices, but possibilities for improvement were present. A detailed cost study of typical farm organization in the area had recently been conducted to provide data on costs and returns.

Livestock and crop returns and cost data were collected for the area, and linear programming was selected as a farm management technique for determining the optimum farm organizations. This technique is a mathematical procedure for selecting the one organization which returns highest income for the given set of resources, depending on the crop and livestock activities made available, the standards for resource use by these activities, the output standards for the activities, and the prices of these outputs.

A model, incorporating the most common enterprises of the Lincoln area, was used for the selection of optimum farm organizations. In the first solution all enterprises included in the model were allowed to enter. In later solutions livestock, except dairy cows, were excluded from each given set of resources to simulate differing farmers' preferences in livestock and to show the sacrifices in income when the more profitable livestock enterprises were not included in the organizations. Optimum programs were developed for varying quantities of land, labor and operating capital which represented resource combinations that might be available on farms. Costs of changes in organization caused by livestock restrictions or additional amounts of labor or capital were deducted from the changes in income; the resulting changes in returns to management (allowing for assumed costs of labor, operating capital and physical changes) were presented as the sacrifices incurred for not having the best possible organization, or the reward for changes in organization which would be made possible with additional labor or operating capital. A farmer would have to compare his own labor and capital situation to the optimum programs; he could then decide on the basis of his own abilities and preferences what changes, if any, in his organization would be profitable and feasible.

Grain farms were the optimum organizations when labor and operating capital were available in limited quantities relative to the land resource. Farms with 200 acres of land, $5,000 or less operating capital and less than a man and a half year-round labor force were grain farms with small livestock enterprises. Farms with 300 and 400 acres of land were all grain farms because of the limited labor supply relative to land.

Hogs were the overwhelming livestock enterprise chosen for maximizing income. All 200 acre farms with $5,000 or more operating capital and a year-round labor force of one and a half men or more were hog farms when all livestock enterprises were allowed to enter. With sufficient resources for a hog enterprise, hogs were invariably the enterprise chosen for maximizing income, and the additional labor and operating capital were most profitably used to expand hog enterprises.

Dairy cows had a place on farms with a fairly large labor supply relative to capital, but here, the farmer would have to weigh the sacrifice in income from not having hogs against personal and financial factors favoring dairying in his particular set of circumstances in order to justify the continuation of a dairying operation. In some situations, the dairy farmer would logically continue his operation because of these factors. Improved productivity of dairy cows and efficiency in the use of labor could put dairy cows in a more favorable position compared to alternative enterprises. Microfilm $2.35; Xerox $8.20. 180 pages.

AGRICULTURE, ANIMAL CULTURE

STUDIES ON EFFECTS OF HIGH ENVIRONMENTAL TEMPERATURE ON THE GROWING CHICKEN

(L. C. Card No. Mic 58-5398)

Kavi Chutikul, Ph.D.
University of Illinois, 1958

Effects of high environmental temperature (90° F. and 50% relative humidity) on growing chickens (5-7 weeks old) were studied in comparison with those obtained at 72° F. and 50 to 70% relative humidity. It was found that, after acclimatization, chickens at 90° F. can maintain normal body (rectal) temperature, this being 106.6° F. This is accompanied by approximately a 25% reduction in feed intake. Twenty-four-hour fasting decreases the rectal temperature of chickens at either 72° F. or 90° F., but the fasting rectal temperature at 90° F. is higher than that at 72° F. Upon exposure to 90° F. environment the rectal temperature of the chicken rises rapidly and reaches a maximum of ap-

proximately 1 to 1.5° F. over that at 72° F. within 2 hours, after which it declines gradually and is back to normal within 8 hours of exposure. Ascorbic acid injection at a dose of 100 mg./kg. body weight fails to prevent or delay the rise in the rectal temperature during the exposure. The fasting rectal temperature of chickens acclimatized at 90° F., however, is depressed slightly by ascorbic acid injection at the same dose.

Plasma total nitrogen and hematocrit value decrease at 90° F., while plasma non-protein nitrogen remains unchanged. It is concluded that an increase in circulating fluid occurs as an adaptation to heat stress.

The protein and lysine requirements of growing chickens are not affected by a moderately high environmental temperature when they are expressed as a percentage of the diet. The absolute requirements for maximum growth, however, are lower at 90° F. than at 72° F. The effect of a moderately high environmental temperature on growth of chickens is mainly in reducing the feed intake in order to maintain homeothermy. Chickens at 90° F. grow better and are more efficient in utilizing the feed for gain than those at 72° F. when both receive the same amount of feed. Chicks at 90° F. also retain more nitrogen, since the chicks at 72° F. must use a larger portion of their protein intake for energy.

Insulin injection at low doses (0.5 to 2 units/kg. body weight/day) causes transient increase in feed intake with consequent increase in body weight gain at 90° F. Higher doses reduce the feed intake and body weight gain. Supplementation of the diet with 0.1% ascorbic acid, acetophenetidin, tolbutamide or a combination of all three compounds fails to increase the feed intake or body weight gain of chickens maintained at 90° F.

Microfilm $2.00; Xerox $4.80. 94 pages.

GENETIC, ANATOMICAL AND PHYSIOLOGICAL ASPECTS OF DWARFISM IN CATTLE

(L. C. Card No. Mic 58-3488)

James C. Dollahon, Ph.D.
The University of Florida, 1958

During the past ten or fifteen years, the incidence of dwarfism in the various breeds of beef cattle has increased at a rapid rate and has become a very serious economic problem. There appears to be several distinct types or forms of dwarfism. The best evidence available indicates that the various types are hereditary; however, the mechanisms of heritability may vary within the same breed and between breeds of cattle.

Anatomical, physiological and genetic aspects of the various forms of dwarfism in cattle were studied. Investigations on certain anatomical and physiological factors were made in an attempt to establish a method for the differentiation of carrier and non-carrier animals of the snorter dwarf gene. Genetic studies were conducted to establish whether a genetic relationship existed between the various types or forms of dwarfism.

Anatomical features of dwarf cattle obtained from dwarf breeding herds at the Beef Research Unit and from various sources in Florida and Georgia were compared with normal controls. Physiological comparisons including a number of different traits were made between snorter dwarf-carrier and assumed non-carrier cattle. Dwarf X dwarf matings were made at the Beef Research Unit.

Results from the anatomical investigations showed that internal hydrocephalus, beaded vertebrae and shortened long bones were the only anatomical abnormalities shown to be consistently associated with the snorter type dwarf. Hydrocephalus and beaded vertebrae were noted in other dwarf types studied, but they were not consistently observed in combination in any dwarf type other than the snorter.

Physiological studies conducted on carrier and non-carrier cattle revealed that the mean corpuscular volume and Ribonucleic acid content of the plasma protein were significantly higher in carrier animals. A highly significant difference in the Desoxyribonucleic acid content of the plasma protein obtained from dwarf-carrier and assumed non-carrier animals was noted. Also, cerebrospinal fluid pressure measurements taken at the atlas-axis junctura showed a highly significant difference between the carrier and non-carrier groups. In all cases there were varying degrees of over-lap between the response of the two groups, which prevented differentiation of the carrier and non-carrier groups with an acceptable degree of accuracy.

The results from the genetic investigation showed:

(1) The midget condition in Brahman cattle appears to be inherited as a recessive trait, although the possibility of an incompletely dominant condition has not been eliminated.

(2) The offspring from a midget Brahman X snorter Hereford mating was a stillborn calf that resembled an extreme snorter type dwarf, which indicates the gene or genes for the midget condition in Brahman cattle may be related to the dwarf genes observed in other breeds.

(3) From a group of matings observed in this study, it appears that the comprest, certain longheaded and snorter type dwarfs are related genetically. The exact genetic relationship of the three types was not determined.

(4) It was shown that a small compact animal known as the guinea in heterogeneous crossbred and Florida native cattle is the heterozygote for a lethal achondroplastic "bulldog" gene. This suggests that the guinea is a descendant of Dexter cattle which are known to have been introduced into Florida.

(5) The introduction of the snorter Hereford dwarf gene into a heterogeneous population produced offspring which were more compact, lighter in weight and higher in slaughter grade than calves sired by non-carrier bulls mated to comparable females.

(6) A midget Brahman bull mated with heterogeneous females produced offspring which were heavier at weaning and graded higher than offspring sired by a normal Brahman bull mated to comparable dams; however, these differences were not significant.

Microfilm $2.70; Xerox $9.40. 206 pages.

THE EFFECT OF ADDING ANIMAL FAT TO PRACTICAL SWINE GROWING RATIONS IN VARIOUS CALORIE TO PROTEIN RATIOS

(L. C. Card No. Mic 58-3170)

Mack Humpherys Kennington, Ph.D.
Purdue University, 1958

Major Professor: T. W. Perry

Three experiments using a total of 138 pigs averaging 30.2 pounds, were conducted to study the effect of the level of added fat, protein levels and Calorie/Protein ratios on the growth rate, feed consumption, feed efficiency and thickness of backfat on growing swine fed to 125 pounds.

A practical swine growing ration containing ground yellow corn, soybean oil meal, meat and bone scraps, dehydrated alfalfa meal, iodized salt, zinc oxide, vitamins-antibiotic supplement and stabilized lard was fed throughout this investigation.

In the first experiment, 9 lots of 6 Duroc pigs each were started at the average weight of 24.7 pounds and fed ad libitum a practical swine growing ration containing 16, 18 or 20 percent protein at 0, 5 and 10 percent added fat for 70 days.

The results indicated that level of added fat influenced growth rate. Level of fat increased feed efficiency. This effect was linear. Level of fat increased backfat thickness, but did not decrease feed consumption. Level of protein did not influence growth rate, feed consumption, feed efficiency or backfat thickness. Calorie-Protein ratio did not influence any of the factors being studied.

The second feeding experiment was conducted with 6 lots of 6 Duroc pigs each averaging 33.3 pounds, and were fed ad libitum rations containing 16.00 percent protein with 0.0, 5.0, 7.5, 10.0, 12.5 or 15.0 percent added fat for 56 days.

Added levels of fat increased growth rate significantly. From 0.0 to 10.0 percent added fat, feed consumption was similar. However at the 12.5 and 15.0 percent added fat levels, feed consumption was markedly reduced. Levels of fat increased the feed efficiency. This effect was highly significant. Backfat thickness was increased by added levels of fat. This effect was also highly significant. There was no relationship between sex of the animal and growth rate, feed consumption, feed efficiency or backfat thickness. As in experiment I, level of protein or Calorie/Protein ratio did not affect the experimental results.

In experiment III, eight lots of 6 crossbred pigs each (weighing 32.7 pounds) were fed rations containing 14 or 18 percent protein with 0, 10, 15 or 20 percent added fat.

An increase in gain in weight due to the added fat was highly significant. Interaction (fat x protein) was not significant, indicating that in general the effect of fat was the same at both levels of protein. If there was any effect of different levels of protein in this experiment, it was not detected due to the variability between animals within lots. Size of the hog (heavy, medium and light) influenced total gain, however all sizes of hogs reacted similarly to treatments. Although the barrows gained faster than the gilts, the over all reaction to treatments was similar. Feed consumption decreased as the levels of added fat were increased. The heavier hogs consumed more feed than the lighter hogs, but all sizes of hogs reacted similarly to treatments. Feed efficiency was increased by added fat. This effect was highly significant. In this experiment, level of protein (14 or 18 percent) significantly effected only feed consumption. The protein x fat interaction was not significant, however, pigs fed 14 percent protein consumed more feed. Possibly these animals were over eating in an attempt to satisfy the protein requirement. Feed efficiency of the different sized hogs was similar. Increased backfat thickness occurred with feeding added levels of fat. This increase in backfat thickness was highly significant. The pigs receiving 14 percent protein had a greater backfat thickness than the 18 percent protein fed hogs. This would tend to substantiate the belief that the pigs receiving the 14 percent protein ration were over eating. There was no effect from Calorie/Protein ratio. Sex did not influence backfat thickness.

Microfilm $2.35; Xerox $8.20. 177 pages.

EVALUATION OF ALPHA CELLULOSE FOR ITS METABOLIZABLE AND PRODUCTIVE ENERGY AND A COMPARISON OF METHODS FOR DETERMINING METABOLIZABLE ENERGY IN THE CHICK

(L. C. Card No. Mic 58-3929)

Lawrence Merle Potter, Ph.D.
The University of Connecticut, 1958

Two experiments were conducted to determine the metabolizable and productive energy of alpha cellulose and to compare three methods of evaluating the metabolizable energy of ground yellow corn and soybean meal--(1) by adding the test ingredient at the expense of cellulose assuming the cellulose has a metabolizable energy of zero, (2) by adding the test ingredient at the expense of a basal diet, and (3) by feeding the test ingredient alone.

In the first experiment alpha cellulose was added at the expense of each of three widely different basal rations, a practical ration, a semi-purified ration, and a purified ration, in increments of 0, 20, and 33-1/3 per cent. After randomizing two-week old male chicks by weight into 57 lots, with 9 chicks each, 3 lots were sacrificed, and the remaining 54 lots were fed the individual diets in duplicate at three levels of feed intake--full feed, approximately 2/3 full feed, and approximately 1/3 full feed. At four weeks of age all chicks were sacrificed and frozen for future analysis. From the various analytic determinations, both metabolizable energy, corrected to nitrogen equilibrium, and productive energy values were found for all diets.

In the second experiment a similar procedure was used to allocate two-week old male chicks into 28 lots. To a modified Cornell E-9 diet, prepared with 30 per cent cellulose in the place of an equal amount of cerelose, 0, 15, or 30 per cent ground yellow corn or soybean meal was added at the expense of the cellulose. To the Cornell E-9 diet (Anderson, Ph.D. thesis Cornell University, 1955) ground yellow corn or soybean meal in increments of 0, 33 1/3, and 66 2/3 per cent was added at the expense of the whole diet. In addition, the same feed ingredients were fed alone. The chromic oxide indicator method was used in both experiments for determining metabolizable energy.

The results of the first experiment showed that the apparent metabolizable energy of alpha cellulose was -0.189

± 0.069 Calories per gram of dry matter and that the productive energy value was -0.093 ± 0.083 Calories per gram. The former value is significantly less than zero. An apparent negative metabolizable energy of cellulose may be explained by possible cellulose absorption and fecal excretion of nutrients which normally would have been assimilated into the body.

The maintenance requirements per gram average live weight obtained among the chicks fed the different basal rations were found to be significantly different ($P < .01$). These different maintenance requirements significantly affected the determined productive energy values for cellulose. These results are evidence to question the validity of the determined productive energy measurements.

The precision in measuring the productive and metabolizable energy of cellulose was found to be nearly the same. However, the average standard errors of the mean determined metabolizable and productive energy for six lots of birds on the same diet were 0.036 and 0.204 Calories per gram respectively.

It was also found that metabolizable energy of the diet was slightly increased by increasing feed restriction.

In the second experiment, the determined metabolizable energy found for ground yellow corn and soybean meal were 3.662 ± 0.080, 3.604 ± 0.105, and 3.394 ± 0.077; and 2.657 ± 0.078, 2.509 ± 0.104, and 2.430 ± 0.129 Calories per gram respectively for the ingredients and for the three methods of evaluation. The determined metabolizable energy of ground yellow corn when fed alone, 3.394 ± 0.088, was significantly lower ($P < .05$) than the value, 3.662 ± 0.080, obtained by the ingredients' addition to a diet at the expense of cellulose. The determined metabolizable energy of the Cornell E-9 diet was found to be 3.336 ± 0.047 Calories per gram which agrees favorably with Anderson's (1955) value of 3.34 ± 0.012.

The coefficients of variation per chromic oxide determination ranged from 2.16 to 3.78 per cent while the coefficients of variation per heat of combustion determination ranged from 0.38 to 1.05 per cent.

Microfilm $2.00; Xerox $6.00. 125 pages.

HEAT-INDUCED COMPLEX FORMATION IN MILK

(L. C. Card No. Mic 58-5378)

Jack Carl Trautman, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor A. M. Swanson

When milk is subjected for forewarming treatments changes occur which usually increase the heat stability of the milk. Accompanying this increase in heat stability are many phenomena which are not readily related to it, but consistently occur with it. These phenomena include chalky flavors in dry milk, differences in the A-C endpoint during cottage cheese making, increase in rennet clotting time, shifts in nitrogen distribution, changes in sedimentation rates, liberation of -SH groups and changes in electrophoretic patterns. Several investigators have reported evidence which suggests that forewarming treatments induce a complex between α-casein and β-lactoglobulin. Such a complex might account for many of the phenomena observed after heating milk. The purpose of this study has been to determine if possible if a stable complex between α-casein and β-lactoglobulin is induced by heating.

Milk was heated in the presence of various -SH group blocking agents and examined electrophoretically. The -SH blocking agents appeared to prevent the heat caused changes in the electrophoretic patterns. Thus it appeared that the -SH blocking agents were preventing complex formation in the intact milk system.

In the isolated system study casein was fractionated by various procedures. Heat induced complexes were formed between these casein fractions and β-lactoglobulin which could be prevented by blocking agents. The effectiveness of the blocking agents appeared to be dependent upon the relative concentrations of the casein fractions and β-lactoglobulin.

Preventing the usual heat caused changes in electrophoretic patterns by -SH group blocking agents is interpreted as strongly supporting the theory of heat-induced complex formation in milk. One criterion for the final proof of this complex would be the successful fractionation of a blocked heated solution of α-casein and β-lactoglobulin and no fractionation of a similar heated solution. Labeled S^{35} β-lactoglobulin would aid the identification of a successful fractionation.

Microfilm $2.00; Xerox $3.00. 60 pages.

AGRICULTURE, PLANT CULTURE

FACTORS INFLUENCING THE AVAILABILITY OF POTASSIUM IN ALLUVIAL AND ASSOCIATED NON-ALLUVIAL SOILS OF INDIANA

(L. C. Card No. Mic 58-3138)

Robert Rexford Binnie, Ph.D.
Purdue University, 1958

Major Professor: Stanley A. Barber

Previous investigations have indicated that certain neutral or slightly alkaline alluvial soils of Indiana will supply more potassium to plants than the amount that would be expected on the basis of the soil test value for exchangeable potassium. Two groups of soil samples were collected, one from alluvial soils, the other from associated non-alluvial soils.

The potassium status in these two groups of soils was evaluated by three methods: potassium uptake by three successive crops of millet, potassium uptake by rye seedlings in Neubauer tests, and release of potassium to boiling HNO_3.

On the basis of the potassium uptake by three crops of millet, there was no difference in the ability of the two groups of soils to supply potassium to plants, assuming equal levels of exchangeable potassium in the two groups.

Neubauer tests were used to evaluate the potassium uptake from the two groups of soils. For the entire population of soils, uptake of potassium was related to the level of exchangeable potassium, but separate regression lines were obtained for the two groups of soils. The regression

coefficients did not differ significantly, but the elevations of the lines did, and indicated that for the same level of exchangeable potassium within the range from 40 to 180 ppm, potassium uptake from the alluvial soils was 67 ppm greater than from associated non-alluvial soils.

Both of these experiments indicated relatively greater uptake of potassium per unit decrease in the level of exchangeable potassium for the alluvial soils compared with the non-alluvial soils. This evidence would indicate that the usefulness of the exchangeable potassium determination for the evaluation of available potassium in alluvial soils is limited.

The content of several clay mineral constituents in the soil was estimated from data obtained in x-ray diffraction analysis of the clay fraction. No statistical correlation was found between clay mineral composition and the amount of potassium taken up by millet or by rye seedlings.

A correlation was found between the amount of potassium released to boiling 1 $\underline{N}$ HNO_3 and the amounts of IOA clay minerals in the samples.

Fixation of applied potassium during moist storage at 60°C was generally greater in the alluvial soils and was correlated with pH and the proportion of previously expanded 2:1 lattice clay mineral that collapsed during 400°C heat treatment.

The evidence indicates that the potassium fixing capacity of these alluvial soils exceeds that of the non-alluvial soils. The results of the Neubauer tests indicate that the availability of nonexchangeable potassium in the alluvial soils exceeds that of the non-alluvial soils. It is suggested that flood waters constitute the probable source of potassium which becomes fixed in certain alluvial soils. It is concluded that the release of potassium from fixed forms in alluvial soils accounts for the greater availability of potassium in these soils compared with non-alluvial soils at the same level of exchangeable potassium.

Microfilm $2.00; Xerox $4.60. 88 pages.

EFFECT OF NUTRITION AND OTHER FACTORS ON FLOWERING, FRUITING, AND QUALITY OF WATERMELONS AND MUSKMELONS

(L. C. Card No. Mic 58-3139)

Blake Bridges Brantley, Ph.D.
Purdue University, 1958

Major Professor: G. F. Warren

Previous investigations reported in the literature on the influence of nitrogen on fruit set and yields in watermelons and muskmelons have produced inconclusive results. Data obtained on yields are contradictory in that increases, decreases, and no response to nitrogen have been recorded. It is not clear whether the responses in fruit set to nitrogen resulted from an effect on percent fruit set or on number of female flowers since detailed studies on flowering and fruit set were not made. Although the evidence indicates that sex expression of monoecious cucurbits can be modified by environment, little information is available as to the effect on andromonoecious varieties.

Six field experiments were conducted to study the effect of nitrogen on flowering, fruit set, and soluble solids in muskmelons and watermelons. The effect of potassium was also studied in two of the experiments. These tests were located in southwestern Indiana on a Princeton fine sand soil type. Pistillate flowers of watermelons and perfect flowers of muskmelons were marked with tags bearing the date of anthesis and the number produced at each date of tagging was recorded. Soluble solids were determined with a hand refractometer.

Greenhouse experiments were designed to study the effects of nitrogen, naphthaleneacetic acid (NAA) and photoperiod on sex expression in the muskmelon.

Applications of nitrogen increased the number of pistillate flowers and fruits set in watermelons. Only slight increases were obtained at rates above 100 pounds of nitrogen per acre. Total yield, earliness, and fruit size were increased by nitrogen in a season of heavy rainfall but not in a moderately dry season. Although the number of fruits set was increased by high nitrogen in a dry season, a high incidence of blossom-end rot in developing fruits caused a reduction in total yield. Pruning fruits to two and three per plant increased the size of melons but had no significant effect on yield.

In a season of high rainfall, 30, 60, and 90 pounds of nitrogen increased the number of perfect flowers, number of fruits set, and total yield in muskmelons, while higher rates caused a depression. In 1956, a moderately dry season, 30 pounds of nitrogen applied before planting increased the number of perfect flowers and fruits set, as well as early yield. Under the same conditions, a medium level of nitrogen (100 pounds) had no effect and a high level (250 pounds) depressed flowering, fruit set, and yield.

Under conditions of heavy rainfall, high levels of nitrogen (150 and 250 pounds per acre) promoted earlier and more abundant flowering and fruit set than lower levels and increased early yield. At these levels, the developing fruits inhibited later flowering and fruit set.

The removal of perfect flowers promoted subsequent flowering. The number of fruits set was tripled by the removal of developing fruits. This response to pruning was greater where nitrogen was applied.

Potassium had no effect on flowering, fruit set, soluble solids, or yield of muskmelons and watermelons.

Nitrogen increased the soluble solids in muskmelons only in the experiments where nitrogen also caused large increases in yield. There was no effect on soluble solids in watermelons.

High nitrogen levels and long days increased the number of staminate and perfect flowers as well as the ratio of perfect to staminate flowers in muskmelons. The number of staminate and perfect flowers was decreased by NAA under long days; however, staminate flowers were decreased to a greater extent. Under short days, .01 ppm NAA increased both staminate and perfect flowers but caused a greater increase in perfect flowers. Higher concentrations at this photoperiod caused a depression in total flowering. Microfilm $2.00; Xerox $5.00. 99 pages.

THE ADAPTATION OF AN ARTIFICIAL RUMEN TECHNIQUE TO THE ESTIMATION OF THE GROSS DIGESTIBLE ENERGY OF FORAGES

(L. C. Card No. Mic 58-3143)

Kenneth Wyllie Clark, Ph.D.
Purdue University, 1958

Major Professor: Gerald O. Mott

There were two principal phases to this study of the use of an in vitro technique. One was the comparison of the dry matter digestion and cellulose digestion of twenty-six grass samples representing thirteen grass species as determined using an artificial rumen pepsin-HCL digestion procedure with the digestion coefficients from the conventional digestion trials. The second phase dealt with a study of the adaptation of such an in vitro technique to the estimation of the gross digestible energy of these forages.

One conventional digestion trial was conducted using five week old, second cut, fertilized orchard grass. This forage was harvested and frozen, then fed frozen to sheep. Samples of this forage were freeze dried and used in the in vitro digestion experiments.

The dry matter digestion coefficient in vivo was 64.8% and the best estimate by the in vitro method was 60.4%. Dry matter digestion estimates as determined by the artificial rumen technique, were significantly correlated (r = .788**) with the conventional trial coefficients.

Cellulose digestion, a frequent criteria used in artificial rumen procedures, was found to be highly dependent on the method of preparation of the rumen inoculum.

The determination of the in vitro digestion of this component was also significantly correlated (r = .71*) with the in vivo coefficients.

The estimation of the gross digestible energy of these forages involved their digestion in an artificial rumen, 100 ml. testtubes, for a period of 48 hours, then following centrifugation and the decanting of the supernatant, a further digestion using 2% pepsin-HCL for 24 hours in a water bath at 39°C. Subsequent to this fermentation the residue was dried, and the remaining energy ascertained by combustion in a Parr oxygen-bomb calorimeter.

The most significant correlation, r = .87**, with the in vivo digestible energy was obtained when the digestion with whole rumen fluid alone was used. However, as the absolute values were somewhat lower than when the additional pepsin-HCL digestion was used, this procedure was chosen when all twenty-six forages were involved.

A poor prediction (r = .447*) was obtained when the gross digestible energy was computed on all the forage samples, and it was found that the addition of such chemical constituents as crude protein, crude fiber, crude fat, cellulose, or lignin, resulted in no improvement in the predictability of the gross digestible energy.

Lignin was the only chemical component correlated with the in vitro estimation of the gross digestible energy of these forages. Microfilm $2.00; Xerox $5.00. 110 pages.

DETERMINATION AND DISTRIBUTION OF FIXED AMMONIUM IN SOILS

(L. C. Card No. Mic 58-5403)

Anand Pal Singh Dhariwal, Ph.D.
University of Illinois, 1958

A procedure based on the ability of HF to remove fixed NH_4^+ from clay minerals was developed for determining naturally occurring fixed NH_4^+ in soils. Interference through deamination of nitrogenous organic compounds by HF was eliminated by treating the soil with hot KOH before removal of the fixed NH_4^+ with HF.

The method devised for measuring naturally occurring fixed NH_4^+ was also suitable for estimating NH_4^+-fixing capacity. The NH_4^+-fixing capacity of a soil where the predominant clay mineral was illite was higher than that of a soil where the predominant clay mineral was montmorillonite.

The amount of fixed NH_4^+ in a number of soil profiles from the North Central Region of the United States was determined. For all soils except those belonging to the Podzol and the Ground-Water Podzol Great Soil Groups, the proportion of N occurring as fixed NH_4^+ was higher in the subsoil than in the corresponding surface soil. From 4 to 10% of N in the surface soil and as much as 40 to 60% of N in the subsoil was fixed NH_4^+. Narrowing of the C/N ratio with depth was found to be due primarily to fixed NH_4^+.

The absolute amount of fixed NH_4^+ in the soil was related to the kind and amount of clay minerals present, the highest amount occurring in these soils where the predominant clay mineral was illite. Analyses of some soils of the Miami catena showed that drainage had no effect on the amount of fixed NH_4^+ in the soil. Similarly, there was no relationship between either the extent of leaching of the soil by percolating water, or the type of vegatative cover, on the amount of fixed NH_4^+, as revealed by analyses of soils belonging to the Chernozem, Brunizem, Chestnut, and Gray-brown Podzolic Great Soil Groups.

Analyses of some soils of a maturity sequence developed from loess in Illinois showed that the amount of fixed NH_4^+ decreased with increasing age.

There was a good correlation between the amounts of N recovered as fixed NH_4^+ and the N released as NH_4^+ by acid hydrolysis, but there was no correlation between organic N and fixed NH_4^+.

Microfilm $2.00; Xerox $4.20. 76 pages.

A STUDY OF THE HERBICIDAL EFFECTIVENESS OF ALPHA-CHLORO-N,N-DIALLYLACETAMIDE WHEN INCORPORATED INTO THE SOIL

(L. C. Card No. Mic 58-5417)

Ralph Lee Gantz, Ph.D.
University of Illinois, 1958

The effect of soil incorporation and other factors on the performance of a pre-emergence herbicide, alpha-chloro-N,N-diallylacetamide (CDAA), was studied in the laboratory, greenhouse, and field. The research was conducted at the University of Illinois, Urbana campus, from 1956 through 1958.

In a two-year field study, soil-incorporated, pre-emergence applications of CDAA gave slightly less grass control than undisturbed applications, but the difference was not enough to be reflected in corn yields. Rain fell soon after treatment both seasons and CDAA gave good grass control at both rates applied. Four pounds per acre did better than two pounds but induced better yields the second year only. No corn injury was detected at either rate during the two years of testing. Cultivation increased yields from all treatments, while the uncultivated four-pound treatments yielded the same as the cultivated, untreated plots both years.

In a relatively smaller field experiment, four pounds of CDAA allowed millet to become established to a certain extent in the absence of a post-treatment rain. Under the same conditions, incorporated CDAA gave complete millet control. The method of application had no influence on grass control when rain fell soon after treatment. This indicates a need for more precise information on the moisture requirements for good weed control without incorporation. In this silt loam soil, CDAA toxicity to annual ryegrass was nearly gone after one week under high soil moisture conditions. When low soil moisture conditions followed treatment, the toxicity from these four-pound applications persisted into the fourth week after treatment. CDAA will apparently not remain active longer than three or four weeks under field conditions favorable for crop growth. This emphasizes the need to delay post-treatment cultivation as long as possible to avoid a recontamination of the soil surface with a new supply of weed seed. Soil incorporation had no visible effect on the persistence of CDAA in these trials.

Laboratory and greenhouse data showed that annual ryegrass emergence and shoot growth were quite responsive to one and ten-pound rates of CDAA. The initial toxicity from the ten-pound rate was absent after four weeks in a silty clay loam soil. The sensitivity of annual ryegrass deserves consideration for semi-quantitative estimates of CDAA in soil under laboratory, greenhouse, and field conditions.

Cucumber root elongation was very reactive to aqueous solutions containing up to four parts per million of CDAA. Bioassay techniques based on this sensitivity were quite satisfactory in general, but like all such procedures, inherent biological variability does not permit the highest level of precision to be attained. Non-biological attempts to obtain an analytical method for CDAA were unsuccessful.

Laboratory studies indicated that dilute aqueous solutions of CDAA were very stable when stored at room temperature for as long as 21 weeks. CDAA activity was not increased when ethanol constituted part of relatively concentrated solutions. This was true even though the corresponding emulsions separated quite rapidly in the absence of an organic solvent. The inhibition to root elongation of cucumber seedlings was not synergistic or even additive in mixtures of CDAA with 2,4-dichlorophenoxyacetic acid (2,4-D).

Several laboratory experiments failed to demonstrate reduction in CDAA toxicity after dilute solutions were exposed to materials such as Wyoming Bentonite, having high exchange capacities. These results do not agree with the available indirect evidence that CDAA is adsorbed in the soil. It may be that some adsorption actually took place in the tests reported here, and the cucumber assay was not sensitive enough to measure it.

Water aliquots aerated with the atmospheres of soil surfaces treated with four-pound rates of CDAA, became quite toxic to cucumbers within three hours. Volatilization represents another reason for incorporating CDAA and similar herbicides into the soil immediately after application. Microfilm $2.00; Xerox $4.20. 80 pages.

GIBBERELLINS AND THEIR EFFECTS ON YIELD AND QUALITY OF BEANS (PHASEOLUS VULGARIS) AND SOUTHERN PEAS (VIGNA SINENSIS)

(L. C. Card No. Mic 58-3491)

Murray Hendricks Gaskins, Ph.D.
The University of Florida, 1958

Field-grown snap beans, Phaseolus vulgaris, and southern peas, Vigna sinensis, were treated with spray applications of potassium gibberellate to determine the effects of this material upon yields of these crops. Trials were also conducted to determine the effects of treating seeds of these plants with potassium gibberellate before planting. When the crops were harvested, investigations were made to determine whether the quality of the vegetables was affected by the spray treatments.

Seeds of snap beans (Contender variety) and southern peas (Cabbage variety) were dipped in a slurry of 10 per cent methyl cellulose containing 0.04 or 0.20 per cent potassium gibberellate. These treatments did not accelerate germination of seed or growth of seedlings. The number of bean plants was reduced by the higher level of seed treatment and all seed applications, including the control containing methyl cellulose alone, had this effect upon southern peas. The higher level of potassium gibberellate caused distorted growth of the bean seedlings. Both levels produced this effect in southern peas. Yields of beans were reduced by the higher level of seed treatment, and both levels reduced yields of southern peas. These effects apparently resulted from the reduced number of plants in seed-treated plots. No beneficial results from the seed treatments were noted with either crop.

In spring trials with Contender beans early yields (combined production of the first two harvests) were 25 per cent higher when a 10 ppm spray application was made at the first trifoliate leaf stage. Lower levels did not cause significantly higher yields. Levels higher than 10 ppm were not used. Total yields (five harvests) were not significantly increased. If a second 10 ppm application was made 10 days after the first, yields were not higher than control plot yields. In fall trials a 20 ppm spray application depressed yields. Yields were not significantly different from control plot yields when lower levels were applied.

Early and total yields of Cabbage variety southern peas were increased, in both spring and fall trials, by spray application of potassium gibberellate. In the spring experiment the highest level used, three 5 ppm applications made 10 days apart, caused 100 per cent and 25 per cent increases respectively in early and total yields. In the fall the same treatment caused similar increases. One 15 ppm spray, applied at the first trifoliate leaf stage, was equally effective in the fall trials.

In an experiment in the fall with a brown-crowder type

southern pea variety, yields were not affected by any level of potassium gibberellate spray applied.

The influence of fertilization rates upon response of southern peas to potassium gibberellate sprays was studied in the fall experiments. Results indicated that the effects of fertilization did not interact with the effects of the spray treatments.

Studies with harvested beans and peas indicated that the treatments used did not cause great changes in the sugars, dry matter, starches or ascorbic acid of these crops. Crude fiber was higher in beans when gibberellate sprays were applied, but with this variety stringiness was not detectably increased. The storage behavior of beans was not affected. Shellout of the southern peas was not significantly altered. It was concluded that no effects were found in these experiments to indicate that the quality of the harvested vegetables was noticeably changed by the potassium gibberellate sprays.

Microfilm $2.00; Xerox $5.40. 106 pages.

PHYSICAL AND CHEMICAL CHANGES DURING THE RIPENING OF TOMATOES AS AFFECTED BY TEMPERATURE

(L. C. Card No. Mic 58-5461)

Hashem Mohamed Moghrabi, Ph.D.
University of Illinois, 1958

Firmness in tomatoes, (Lycopersicon esculentum) as in many other fruits is an important factor of quality. The present investigation was an attempt to determine some of the physical and chemical changes in the flesh of tomato fruits during ripening as related to temperatures. Homogeneous tissue of the inner pericarp was tested for firmness and analyzed for pectic constituents and total carotenoids.

Exposure of tomatoes to a temperature of 40°C for one or two days greatly increased the rate of softening. Strikingly less softening was shown in tomatoes exposed at 35°C. At temperatures of 15°, 20°, 30°, and 35°C, fruit firmness decreased sharply for the first three days of ripening and leveled off thereafter. Softening was strikingly retarded at 15°C during the early stages of ripening.

Fruits of Stokesdale variety exposed to 35°C were consistently higher in protopectin and total pectin than those exposed to 15°, 20°, and 30°C. All pectic fractions decreased during ripening, but protopectin showed more rapid rate of loss as well as the greatest loss. Degradation of pectins proceeded during ripening and was most rapid in fruits exposed to a temperature of 40°C. Protopectin contents dropped very sharply at all temperatures (15°, 20°, 30° and 35°C) during the first three days of ripening. The rapid loss of firmness during this period indicates a relationship between early softening and degradation of protopectin. The loss in water soluble pectin was gradual. The slowest rate occurred at 20°C and the most rapid at 30°C. The rates of loss of pectates at the different temperatures changed during ripening perhaps indicating the variable nature of this pectic fraction.

The highest rate of weight loss occurred to fruits exposed to 40°C where relative humidity was 23 percent. The lowest rate of weight loss occurred when fruits were exposed to 15°C where relative humidity was 87%.

Carotinoid formation was most rapid at 20°C. At 15°C the rate was initially slow but the final rate was very high. At this temperature fruits were firmest at a given carotenoid content. At 35°C little or no pigment was formed.

Microfilm $2.00; Xerox $3.60. 65 pages.

A STUDY OF THE STRUCTURES AND PROPERTIES OF CERTAIN TETRA-ALKYL AMMONIUM MONTMORILLONITES

(L. C. Card No. Mic 58-3198)

James Maurice Spain, Ph.D.
Purdue University, 1958

Major Professor: Joe L. White

Titration Studies

H-Al bentonite suspensions were titrated conductometrically with several tatra-alkyl ammonium bases. The resulting titration curves were very similar to those obtained with strong inorganic bases. Reproducible results were difficult to obtain when titrating in the conventional manner, adding successive increments of base to the same sample of clay suspension. After each addition, the resistance of the suspension continued to change for a long period of time.

A technique was devised whereby this problem could be avoided. Separate small aliquots of clay suspension were titrated with different increments of base equivalent to successive points on a titration curve. This technique also afforded an opportunity to examine the magnitude and rate of the resistance change after the addition of any given increment of base. For LiOH and $(CH_3)_4NOH$, two to three hours were required for the resistance of the suspensions to level off. This leads one to conclude that conventional titrations, even with strong inorganic bases may be subject to rather serious error.

X-Ray Studies

Expanded Delamica was prepared by leaching with molten $LiNO_3$. Tetra-alkyl ammonium compounds reacted with this expanded Delamica to form stable complexes unusually well suited for x-ray diffraction studies. As many as 19 basal reflections from these complexes were obtained, using a General Electric XRD-5D1 x-ray diffractometer unit with a Speedomax recorder attached. Using intensity values thus obtained, Fourier syntheses were computed for the expanded Delamica complexed with the following cations, the values for d_{001} in angstroms being given in parentheses: $(CH_3)_4N^+$ (13.70), $(CH_3)_3N^+C_2H_4OH$ (13.92), $(C_2H_5)_4H^+$ (14.03), $(C_2H_4OH)_4N^+$ (14.12), $(CH_3)_3N^+C_6H_5$ (16.96). The syntheses gave evidence to support the postulation that in the case of the first two cations, a methyl group keys partially into a hexagonal cavity in the silicate surface.

Fourier syntheses for muscovite and the untreated Delamica were also calculated. These exhibit excellent agreement, one with the other. There is in general, good agreement between the silicate structures indicated by the Fourier syntheses of the organo-clay complexes and the known structure of the mineral.

Microfilm $2.00; Xerox $4.40. 85 pages.

PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF 2,4-DICHLOROPHENOXYACETIC ACID ON CELLULAR METABOLISM IN PLANTS

(L. C. Card No. Mic 58-5519)

Sherlie Hill West, Ph.D.
University of Illinois, 1958

Theories that have been advanced for the mechanisms whereby 2,4-dichlorophenoxyacetic acid (2,4-D) kills broad leaf plants do not fully explain the herbicidal action of the chemical and cannot serve as a basis for predicting other useful herbicides. The purpose of this study was to determine if RNA metabolism, one of the basic biochemical phases of plant growth, is affected by treatments of 2,4-D.

The sensitivity of garden cucumber (Cucumis sativis) and bur cucumber (Sicyos angulatus) was established and the effects of the herbicide on these plants were described. The growth of garden cucumber plants in the greenhouse was increased by a foliage spray of 40 p.p.m. 2,4-D or 2,4,5-T and inhibited by concentrations in excess of 160 p.p.m. Plants of both species sprayed with 160 and 320 p.p.m. 2,4-D or 2,4,5-T exhibited greatest epinasty, stem bending and stem proliferation. A concentration of 1600 p.p.m. was necessary to affect a 50% kill in bur cucumber whereas only 320 p.p.m. 2,4-D was needed to completely kill the garden cucumber plants.

The effect of a lethal application (400 p.p.m.) of 2,4-D on ribonucleic acid and protein levels of the leaves and stems of cucumber plants in the greenhouse was observed. Ribonucleic acid and protein levels increased in the stems and were not altered in the leaves of plants sprayed with 2,4-D.

Total and particulate levels of RNA and protein in isolated cucumber and corn sections floated 12-15 hours in 2,4-D solutions was determined in order to establish whether the effects of the herbicide on RNA metabolism could be studied under more controlled conditions. The normal expansive growth of isolated stem tissue from etiolated corn and cucumber seedlings was accompanied by a reduction in total and particulate RNA. Low growth-promoting concentrations of 2,4-D slightly accelerated the degradation; while growth-inhibiting concentrations inhibited the degradation.

The enzymatic degradation of microsome particles isolated from corn and cucumber seedlings and incubated for various time intervals showed a dependence for phosphate or arsenate. Potassium ion or ethylenediaminetetra-acetic acid activated the enzymatic degradation by dispersing the microsomes into smaller units which did not sediment at 100,000 x g. The degradation of the microsomes was inhibited by calcium or magnesium ions.

The potassium and 2,4-D relationships in growth, respiration, and RNA metabolism in isolated cucumber hypocotyl sections were observed and were shown to be functional. The effects of KCl and 2,4-D were synergistic in promoting growth, and additive in increasing respiration and in accelerating the degradation of RNA in cucumber tissue.

It was concluded that 2,4-D affects the RNA metabolism of cucumber and corn plants and that the promotion and inhibition of growth resulting from 2,4-D applications may be related to RNA metabolism.

Microfilm $2.00; Xerox $4.80. 92 pages.

A STUDY OF THE NUCLEI OF THE MEDULLA ABLONGATA, PONS, MESENCEPHALON, AND DIENCEPHALON OF THE BRAIN OF THE DOMESTIC TURKEY, MELEAGRIS GALLOPAVO

(L. C. Card No. Mic 58-3989)

John Henry Milliff, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Donald Duncan

This dissertation reviews the literature on the morphology of the nuclei of the avian brain stem (medulla oblongata, pons, mesencephalon and diencephalon) and describes these nuclei in the brain of the domestic turkey, a form which has not been previously studied in this manner. The description of the turkey material is based on sections of seven brains. Five of them were serially sectioned in the transverse plane and stained as follows: (1) one with a silver stain for axons, (2) one with Lillie's variant of the Weil-Weigert method for myelin, (3) one with toluidine blue for cell bodies, (4) one with cresyl echt violet for cell bodies, and (5) one by Kluver and Berrera's method for myelin and cells. The sixth brain was serially sectioned in a sagittal plane and stained with cresyl echt violet for cell bodies. The hypothalamic region of the diencephalon of the seventh brain was divided in the sagittal plane and one-half was sectioned in the transverse plane while the remainder was sectioned in a sagittal plane. Both of these halves were stained with Dawson's modification of Halmi's stain for neurosecretion. With few exceptions, the sixty-one nuclei described in this study conform in locations and cell-types to descriptions of the nuclei of avian brains presented by former investigators. A study of the sections substantiated the presence of an avian pons as presented by Brodal, Kristiansen, and Jensen. The intermediate nucleus sends some or all of its fibers to the root of the vagus nerve. Of the hypothalamic nuclei, the supraoptic nucleus presented the greatest deviation from former descriptions by its more lateral and rostral location. Dawson's modification of Halmi's stain for neurosecretion showed positive evidence for neurosecretory material in the cells of the supraoptic nucleus as well as in the infundibulum and pars nervosa of the hypophysis cerebri. Furthermore, cells in the periventricular area of the preoptic region also were stained by this method. The cells of the latter area are comparable in their location to the cells of the paraventricular nucleus of mammals; consequently, the name, paraventricular nucleus, is suggested for the cells in this location in avian forms.

Microfilm $2.00; Xerox $7.00. 146 pages.

ALFRED RUSSEL WALLACE: HIS ROLE AND INFLUENCE IN NINETEENTH CENTURY EVOLUTIONARY THOUGHT

(L. C. Card No. Mic 58-3335)

Gerald Mitchell Henderson, Ph.D.
University of Pennsylvania, 1958

Supervisor: Loren C. Eiseley

This dissertation examines the scientific contributions of Alfred Russel Wallace, with special reference to evolution and anthropology. Wallace's role in forcing Darwin to publish is reexamined, and the origins of Darwin's and Wallace's theories are explored.

The primary source materials employed include the major writings of Wallace and Darwin, as well as their contemporaries, the reviews and criticisms of their theories, as well as a study of the correspondence between Darwin and Wallace and their associates. Wallace's life work is examined both in the light of recent research and the illuminating insights furnished by the histories of the intellectual climate of the nineteenth century.

In summary, Wallace's contributions to evolutionary and anthropological thought include:

1. He arrived independently at the complete theory of natural selection. Although stimulated by Darwin's Journal of Researches Wallace grasped the importance of every necessary ingredient in evolution, and thus forced Darwin to publish.

2. Wallace's evolutionary hypothesis developed primarily out of his attempt to bring order out of the evidence of distribution of varieties, species and genera.

3. He was among the first to advocate the idea that the geographical relations of species and genera require an evolutionary hypothesis and to state this fact openly.

4. He insisted that natural selection was the primary factor in evolution, rejecting inheritance of acquired characteristics, and sexual selection.

5. He sought to explain animal behavior in terms of learning, rather than instinct.

6. He organized the principles of mimicry, developed by Bates and Müller, into a general theory of warning and protective coloration in animals.

7. In zoogeography he is still recognized as an important authority. He championed the permanence of the existing continents and oceans in their present locations and with no major changes in their general outlines, and he attempted to explain animal distributions on this basis.

8. He contrasted continental islands, those easily reached by mainland plants and animals, with oceanic islands, which receive their flora and fauna as a result of sporadic, chance dispersals.

9. Wallace's Line is a demarcation between a continental and an island fauna, rather than the sharp boundary between two zoogeographical realms which Wallace originally believed it to be.

10. Wallace's study of the orang-utan contributed to the rise of improved methods in surveying the social behavior of the great anthropoids.

11. His views on human evolution included the assumption that men had split off from the other primates early in the Tertiary, and that some force other than natural selection was necessary to explain the origin of man.

12. He developed the idea that after man attained the cultural level of existence natural selection ceased to be an important force in further human development.

13. His classification of the human races of Australasia includes many points basic to modern classifications. He was the first person to recognize the possible Caucasoid affinities of the Australian aborigines, and their similarity to other Eastern Caucasoids, e.g. the Ainu.

14. Wallace's primary influence in anthropology lies in his rejection and criticism of the unilinear dogma of cultural evolution, especially in regard to religion. His biological studies of migration and his formulation of principles of distribution indirectly influenced twentieth century ethnological methodology.

Because of his advocacy of socialism, spiritualism, and other unpopular causes, Wallace's contributions to evolutionary thought have been obscured and distorted. This study re-establishes his role and influence in nineteenth century thought.

Microfilm $4.25; Xerox $14.40. 332 pages.

THE CARIBBEAN FAMILY: A CASE STUDY IN MARTINIQUE

(L. C. Card No. Mic 58-2692)

Mariam J. Kreiselman, Ph.D.
Columbia University, 1958

In this dissertation a model is created to account for facts pertaining to marriage and family organization in a plantation village and its surrounding countryside in Martinique, an island of the French West Indies. The village, called Capesterre, shows a high rate of illegitimacy, but there is no indigenous substitute for legal marriage, for some births are legitimate.

By means of the community study method, the above facts are examined in relation to their total context. The analysis shows multi-racial Martinique to possess a subculture within which family organization differs from that of the dominant group, among whom one finds the standard Western patterns. Capesterre (population 3,871) is representative of that sub-culture with the exception of a half-dozen white planter families and a few of the mulatto elite. The majority, including professionals and rich shopkeepers as well as the rural proletariat, have a distinctive grammar of values reflected in their deviant family structure.

A model of this structure can be summarized in the

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

following manner. It permits the simultaneous existence of three sanctioned family types usually not found together in one social system: the conjugal, the sub-conjugal, and the supra-conjugal. The conjugal family is a mated pair and their children living as a separate unit. Less than such a unit is sub-conjugal: a woman and her children alone. In Martinique the supra-conjugal family involves a woman or a couple, one or more children, and the offspring of the latter.

Such a model is the counterpart of the structural possibilities implicit in a value system lacking what Malinowski calls a "rule of legitimacy," the universal insistence that a girl be married before having children, an insistence leading to differential treatment of illegitimate children.[1] In Capesterre, among the non-elite, there is no distinction between "a group-sanctioned bond between a man and a woman, and the type of permanent or temporary union resulting from . . . consent alone."[2]

Among the problems treated in analyzing the above situation is the question of institutional remoteness of the father-husband, a feature frequently found in the Caribbean. A further problem is that of the articulation of legal marriage with the household. And finally there is the question of explanation, both historical and functional.

The findings are documented by survey material, civil records, and data dependent on participant observation.

Microfilm $4.25; Xerox $14.20. 329 pages.

1. B. Malinowski, Sex and Repression in Savage Society (Meridan Books, Reprint, 1955), p. 187.

2. Claude Lévi-Strauss, "The Family," Man, Culture and Society, ed. Harry L. Shapiro (Oxford: Oxford University Press, 1956), p. 268.

A CASE STUDY OF CULTURE CHANGE IN THE TERRITORY OF PAPUA

(L. C. Card No. Mic 58-3846)

Robert Francis Maher, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor David A. Baerreis

The objective of this study was to examine the changing culture of the people of the Purari Delta, Territory of Papua, from the reference points of three principal hypotheses, two of them general expressions of widely accepted cultural theory and the third a more specific and possibly more controversial statement. The hypotheses were as follows:

1. Since the elements of a culture are functionally interrelated, then changes in one element will produce changes in others.
2. Certain elements, however, are more essential to a particular way of life than are others. Consequently, changes in these important features produce more significant reactions in other parts of the culture than do alterations in less important elements.
3. Culture contact, particularly in the Pacific area, which is so overwhelming as to radically disorganize focal points--i.e., interconnections of basically important cultural elements--in the Native culture, may be expected to set in motion a depopulation process within the Native society.

The Purari Delta culture was selected for study because reliable reports indicated that it was experiencing some important changes and a reasonably large amount of literature existed which referred to the culture as it was in early contact times. Particularly important here were F. E. Williams' The Natives of the Purari Delta, Anthropology Report No. 5 (Territory of Papua: 1924) and J. H. Holmes' In Primitive New Guinea (London: Seeley, Service and Co. Limited, 1924). Combining these sources, Government Patrol Reports, and the results of 10 months field work in the area in 1954-55, the present study attempts to describe what has changed in Purari culture and to interpret the direction of change in a framework that has reference to the three hypotheses.

An analysis of the early sources showed that much of the particular quality of traditional Purari culture emerged from the interaction of the several enduring patterns of behavior and belief involved in the imunu concept, the social and ceremonial structure, warfare and cannibalism and the subsistence system as it developed from the influences of Purari technology and the local swamp ecology. It was also seen that a consequence of this complex of factors was a strong emphasis on the village level of sociocultural integration.

Contact with European culture brought with it some welcomed but relatively minor changes in technology and a resisted but eventually successful eradication of warfare and cannibalism. The latter created a major break in the interlocked structure of Purari institutions and led to new types of behavior as adjustment was sought.

By 1955, radical changes were found to have occurred in the ceremonial and kinship systems and in the residence patterns as a consequence of the loss of the war institutions. The broad processes of change were epitomized in the explosive Tommy Kabu Movement which developed after World War II as a search for cultural solutions patterned after European models, and a measure of the disruption of the cultural system was found in a marked decline in population number.

Microfilm $3.00; Xerox $10.40. 232 pages.

CHILD REARING AND FAMILY ORGANIZATION AMONG PUERTO RICANS IN EASTVILLE: EL BARRIO DE NUEVA YORK

(L. C. Card No. Mic 58-3236)

Joan P. Mencher, Ph.D.
Columbia University, 1958

Research objectives were: (1) an ethnological description of child rearing among Puerto Ricans living in a slum of New York City; (2) systematic comparisons of child training and behavior between extended and nuclear Puerto Rican families in the slum and those of Puerto Ricans in rural sugar growing parts of Puerto Rico as studied by various anthropologists; (3) the determination of the relationship between family organization and the acceptance of culture change as regards child rearing behavior and attitudes among first generation Puerto Rican migrants.

This research resulted from the writer's participation in a more extensive anthropological project, the Foresight Family Health Study which was directed by Dr. Elena Padilla. The Foresight Study was under the auspices of the Columbia University Department of Anthropology and the aegis of Dr. Charles Wagley. The objective of the larger project was the delineation of the ways of life and attitudes of Puerto Ricans living in a particular slum neighborhood of New York City, Eastville (pseudonym). In this area, Puerto Ricans are rapidly displacing the older ethnic groups as migration from the Island continues. While a few second generation Puerto Rican families lived in the neighborhood, the study concentrated on the first generation families, most of whom arrived after 1945.

In accomplishing the objectives of this research, data from the entire project has been used as well as the more specialized data on child rearing during the first six years of life collected by the writer. Methods of study include: structured and unstructured interviews with parents; observations of parents; unstructured interviews and observations of children at home, on the streets and parks, and in the local kindergartens and nursery schools; interviews with teachers and other service personnel in the area.

For the purpose of systematic comparison, intensive studies made in the sugar cane regions of Puerto Rico were used. Many of the migrants to Eastville spent their early childhood in these regions, coming subsequently to the slums of Puerto Rican cities and thence to New York City. Of the Eastville inhabitants who came directly from a rural setting, the majority are from sugar production regions. Since studies have not been made of slums in the Island cities, no data on slum dwellers in Puerto Rico was available for comparison.

In regard to the third objective of this research, it was found that members of the Eastville Puerto Rican extended families are the most accepting of culture change in child rearing behavior and attitudes. While the traditional Puerto Rican family structure in the sugar cane region is of the matrilateral extended type, many conjugal families are forced into a nuclear structure in Eastville, largely because of accidents of migration. While this family structure is more similar to the American, from the point of view of Eastville adults nuclear family living is a "hardship," and adult members of such families tend to accentuate the traditional patterns of child rearing in an attempt to maintain as much as possible of the existing social system. On the other hand, the extended family is seen by its members as carrying on in the traditional form and it is not as necessary for its members to cling to traditional patterns of child rearing. Thus it may be seen that as regards child rearing, the family able to maintain the traditional form of organization is most accepting of culture change. Microfilm $4.85; Xerox $16.20. 380 pages.

ARCHEOLOGICAL STUDIES OF FIVE WISCONSIN ROCKSHELTERS

(L. C. Card No. Mic 58-5383)

Warren Lee Wittry, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor David A. Baerreis

Archeologists working in the Wisconsin area have been somewhat handicapped by a lack of locally obtained chronological information. This situation has made it necessary to reconstruct the sequence of local cultures largely by comparisons with the sequences developed in adjacent areas from more abundant stratigraphic data and, more recently, from radiocarbon dating. One problem, in particular, which has received a degree of attention, but which has not been adequately resolved, is concerned with the cultural and chronological relationships between the Wisconsin Hopewellian and Effigy Mound cultures.

A search for stratified sites which would provide data bearing on prehistoric chronology in general and on the Hopewellian-Effigy Mound relationships in particular led to the rockshelters of the glacially Driftless Area of southwestern Wisconsin. Several of these natural shelters which were occupied by various prehistoric Indian groups were so situated as to have local geologic conditions favorable to the formation of a stratified deposit. Excavations were conducted in five rockshelters located in the eastern part of the Driftless Area. The great majority of the artifacts found belong to the cultures of the Archaic and Middle Woodland periods. Since the cultural and natural stratigraphies of the sites were essentially undisturbed, the relative chronological positions were determined for a number of chipped-stone and ceramic artifact types.

The earliest occupations, as represented by the deepest materials, are closely related to the Old Copper culture, the best known Archaic culture of the Wisconsin area. The rockshelters probably represent occupational sites of this complex, previously known only through surface finds and the excavation of cemeteries.

The excavations established a stratigraphic sequence of Middle Woodland pottery types which clarifies the temporal relationship between Wisconsin Hopewellian and Effigy Mound. Denzer Stamped, a pottery type also found in the Trempealeau and Red Cedar River foci of Wisconsin Hopewellian, and which resembles Havana pottery of Illinois, was found stratigraphically earlier than Madison Plain and Madison Cord Impressed, two pottery types associated with the Effigy Mound culture. Leland Cord-marked, the local equivalent of the Illinois Weaver ware was found to have a stratigraphic position later than Denzer Stamped and earlier than Madison ware. The data from the rockshelters, certain radiocarbon dates, and other recent information are briefly summarized as evidence for the local emergence of the Effigy Mound culture after classic Hopewellian had died out in the area. The temporal dividing line between the two is postulated at about 500 to 600 A.D. A survival of Effigy Mound from the Late Middle Woodland period into the Mississippi period is indicated. This interpretation places the Effigy Mound culture somewhat later in time than the interpretations existing at the time the study was initiated.

Since both Wisconsin Hopewellian and Effigy Mound have been defined primarily from excavations in burial mounds,

the data obtained from the rockshelters can be utilized for a further understanding of these cultures.

The relative numbers of various artifact categories (scrapers, knives, etc.) in proportion to the number of projectile points in the various levels indicate that these rockshelters were utilized as primary habitation sites during the Archaic period and as auxiliary hunting stations by the partly food-producing cultures of the Middle Woodland period. Practically no remains of the Paleo-Indian, Early Woodland, and Mississippi culture periods were found in the sites investigated.

Microfilm $2.50; Xerox $8.60. 190 pages.

ASTRONOMY

STUDIES OF RADIO FREQUENCY RADIATIONS FROM THE PLANETS

(L. C. Card No. Mic 58-3483)

Thomas Deaderick Carr, Ph.D.
The University of Florida, 1958

Sporadic bursts of radio noise from Jupiter were studied during the winter and spring seasons of 1956-1957 and 1957-1958 on the frequencies 18, 22.2, and 27.6 Mc/s. Saturn, Uranus, and Venus were also monitored to determine whether or not they emit similar radiation. An antenna development and construction program of considerable magnitude was carried out to make the planetary studies possible.

The observations indicated that the sources of radio noise on Jupiter are concentrated within certain zones of longitude (as had been reported earlier by others). The noise centers appeared to be rotating with a period 11.8 seconds shorter than the period of the System II longitudes, and seem to have maintained a fixed relationship over a number of years. It is suggested that they are attached to the solid surface of Jupiter, which cannot be observed with telescopes because of perpetual clouds, and provide for the first time a means for determining the true rotational period. Evidence for the existence of an ionosphere surrounding Jupiter was found, the electron density of which is apparently comparable with that of the terrestrial ionosphere. It was also found that the radiation from Jupiter is elliptically polarized in the right-handed sense, indicating the presence of a Jovian magnetic field as well as an ionosphere. Calculations based on the measured values of the polarization and on the assumed location of the magnetic poles relative to the noise centers indicated that the magnetic field strength at the surface is about ten times greater than that on earth. An observed periodicity of eight days in the noise activity is attributed to the influence of one of Jupiter's satellites upon its ionosphere.

Radio noise believed to have originated on Saturn was received on several occasions. A statistical analysis revealed that Saturn is a less active noise emitter than is Jupiter. No radiation was received from Uranus during a long series of observations. It was concluded that if Uranus emits at all, it cannot be more than 1/10 as active as was Jupiter. No radiation was received during a long series of observations of Venus. A transitory focusing effect of the terrestrial ionosphere upon rays from Jupiter at sunrise is believed to have been discovered.

Microfilm $2.25; Xerox $8.00. 171 pages.

BACTERIOLOGY

THE RESPONSE OF VARIOUS BACTERIA TO DRYING IN AN AIR STREAM

(L. C. Card No. Mic 58-5335)

Carl William Bruch, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor E. M. Foster

This investigation was undertaken to provide information that could be applied to the spray drying of bacteria. The specific goal was to observe the behavior of vegetative cells of various bacteria when dried in an air stream and to determine if any general characteristics of the different genera could be related to requirements for certain protective substances in the drying menstruum. Most of these comparisons were made with a modified Naylor and Smith diluent and its components, which are 2 per cent dextrin, 0.5 per cent each of ascorbic acid the thiourea, and 0.05 per cent peptone.

The basic method consisted of suspending the bacteria in various diluent mixtures and then drying aliquots of the suspensions on nylon cloth through which was passed a stream of air at a controlled temperature, relative humidity, and flow rate. After the drying period was completed, the cells were rehydrated in a solution of 0.1 per cent peptone. Spread plates were used for the viability assays before and after drying.

The microorganisms dried were Serratia marcescens, Escherichia coli, Aerobacter aerogenes, Alcaligenes viscosus, Lactobacillus casei, Streptococcus lactis, Staphylococcus aureus, Salmonella typhimurium, Azotobacter

vinelandii, Pseudomonas fluorescens, Bacillus subtilis var. niger, Clostridium pasteurianum, and T1 coliphage.

The strictly aerobic and facultative bacteria survived poorly unless they were protected with dextrin and antioxidants (ascorbic acid and thiourea). Both components were required for maximum survival under the conditions of test. S. lactis and L. casei, however, survived well without protective materials. The strict anaerobe, C. pasteurianum, was not dried successfully by any method tried.

In the absence of antioxidants drying with nitrogen gas increased the survival of the strict aerobes and facultative organisms, thus indicating that air drying damaged an oxygen-labile system in the cells. L. casei, however, survived equally well when dried with air as with nitrogen regardless of the diluent. This organism is essentially indifferent to oxygen.

The gram positive species as a group were more resistant to drying than were the gram negative species.

Comparison drying tests between the cloth dryer and a pilot scale spray dryer showed significant statistical correlation between the results for S. marcescens and L. casei but not for A. aerogenes and E. coli. In general, any cell suspension that dried poorly on the cloth dryer gave low survival in the spray dryer, but suspensions that survived well on the cloth dryer did not necessarily survive well during spray drying. These studies corroborated the earlier observation that L. casei did not require the modified Naylor and Smith diluent for survival whereas S. marcescens, E. coli, and A. aerogenes did.

The effects of several other factors that might influence survival were investigated in an attempt to explain how the antioxidants in the Naylor and Smith diluent exert their protective effect. These experiments included cytochrome poisoning with carbon monoxide and cyanide, nitrogen gas sparging of suspensions before drying, protection of sulfhydryl groups with p-chloromercuribenzoic acid, the use of different antioxidants for ascorbic acid and thiourea, and the presence of small quantities of iron in the cell suspensions. However, none of these trials showed the specific part of the cell that is protected by the antioxidants.

Infection of a culture of S. marcescens with bacteriophage gave no clear-cut evidence that the presence of phage materially influences the ability of this organism to survive drying. However, phage-resistant isolates of this organism were considerably less sensitive to drying than was the phage-sensitive parent culture.

Microfilm $2.00; Xerox $6.20. 129 pages.

NUTRITIONAL STUDIES ON AZOTOBACTER AND ITS MUTANT

(L. C. Card No. Mic 58-3964)

Ming-Yu Wang Chu, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Orville Wyss

This dissertation is concerned with two general research problems. Each will be discussed separately.

The Mineral Nutrition of Azotobacter

The calcium requirement of azotobacter in nitrogen fixation has been demonstrated by two general methods. The first of these involves the formation of stable complexes between chelating agent (EDTA) and calcium. The second general method is by the use of inhibitory effects of high concentration of strontium and magnesium. Either one of these methods would result in obtaining a medium effectively deficient in calcium. By the addition of graded amounts of calcium to a series of tubes, a standard growth curve was obtained. Strontium was found to be able to replace calcium requirement at a molar ratio of 1.1:1.0. Higher concentrations of calcium were found to be inhibitory, possibly as a result of inbalance or an antagonistic effect on other cations which are also required by the azotobacter.

NH_3 has been proposed to be intermediate of biological nitrogen fixation and some investigations have suggested that calcium was needed only for the conversion of N_2 into NH_3. In our work calcium has been demonstrated to be required by azotobacter. NH_3 or nitrate as well as N_2 serve as the source of nitrogen. This finding is supported by experiments employing the EDTA chelation method and by the experiments showing reversal by calcium of the inhibition resulting from high concentrations of strontium. It was concluded that calcium is required not only for the reaction between N_2 and NH_3 (the supposed intermediate), but is mostly concerned in other metabolic processes, and is required irrespective of the source of nitrogen.

Pyridoxamine, 0.0001 μg per tube, was shown to replace the calcium requirement in media containing high concentrations of magnesium. The combinations of the amino acids, arginine, alanine, histidine and tyrosine, were demonstrated to replace calcium requirement partially, or to reduce calcium requirement in relieving the inhibition by EDTA or high concentrations of magnesium or strontium. It was concluded that calcium and pyridoxamine, admittedly in some indirect manner, are involved in the same function for catalysing the biosynthesis of those amino acids which showed a sparing or substitution effect.

The free amino acid content was found to be more varied in the azotobacter cells grown in free nitrogen than $(NH_4)_2SO_4$.

Nutritional Studies of the Mutant of Azotobacter

SM-resistant mutants of Azotobacter agilis were isolated by a procedure involving incubation in the presence of high concentrations of the drug.

The cytochrome spectrum of parent cell (A. agilis) was observed to contain absorption bands at 530-, 555- and 630-mμ which distinguished it from the cytochrome spectrum of SM-resistant mutant in that one of the absorption bands, 630-mμ, had lost.

Brain heart infusion at concentration too high or too low was observed to give a toxic effect or a less growth. On the other hand, enzyme hydrolysed casein was found to increase the yield of mutant cell with increasing concentrations.

Manganese was found to be required by SM-resistant mutant in addition to the amino acid mixture. This requirement was demonstrated indirectly by the EDTA chelation experiment, and directly by ashing 1 ml of catalase containing 4.53 per cent residue, and the addition of $MnSO_4$, 4 mg per tube, in 19 amino acid mixture, could provide growth almost close to the optimum while the addition of other metal ions tested failed to provide growth.

Microfilm $2.00; Xerox $4.80. 95 pages.

HEMAGGLUTINATION WITH HERPES SIMPLEX VIRUS

(L. C. Card No. Mic 58-3868)

Frances G. Felton, Ph.D.
The University of Oklahoma, 1958

Major Professor: L. Vernon Scott

Hemagglutination with viruses was first described independently by Hirst (1941) and McClelland and Hare (1941) who used influenza virus. This principle has also been shown with a number of other viruses, e.g. mumps, Newcastle disease virus and vaccinia. Hemagglutination had not been shown with herpes simplex virus. This phenomenon can be demonstrated with bacterial agents as well as with viruses. With bacterial agents, it has also been shown that an indirect type of hemagglutination can occur. This indirect type involves a modification of the red blood cells and the addition of homologous antibody for hemagglutination to occur. Several types of indirect hemagglutination exist. This study is the application of one of these indirect types to a virus, herpes simplex.

Herpes simplex virus, which by the usual technique of hemagglutination is inactive, has been shown to produce hemagglutination in the presence of specific immune sera.

This virus was adsorbed onto sheep erythrocytes which had been pretreated with tannic acid. These tannic acid treated-virus sensitized red cells were agglutinated in the presence of specific immune sera. The amount of virus used in the sensitization process had a direct effect upon the hemagglutinative titers of the sera. The preparation of reagents and the procedures followed have been described.

The antibody in herpes simplex immune sera can be removed by adsorption with tannic acid treated-virus sensitized erythrocytes. The removal of this antibody as demonstrated by both hemagglutinative and infectivity techniques indicates that the herpes simplex neutralizing and hemagglutinating antibodies are probably identical and that a specific antigen-antibody reaction is involved in the herpes simplex hemagglutination test.

Factors affecting the herpes simplex hemagglutination test were examined to show the range and optimum requirements necessary for the proper performance of the test. Factors investigated were: (1) the size of the test tube used in the test, (2) the time and temperature of incubation of the test, (3) the concentration of tannic acid used to treat the erythrocytes, (4) the pH of the saline used in the sensitization of the cells with virus, (5) the time required for this sensitization, (6) the use of erythrocytes from different species, (7) the type of serum used for the serum diluent, and (8) various methods of preparation and preservation of the viral antigen.

The herpes simplex hemagglutination test, when controlled by limiting factors, is a sensitive, specific and reproducible new serological test.

Microfilm $2.00; Xerox $4.20. 76 pages.

SOME METABOLIC ACTIVITIES, NUTRITIONAL AND GASEOUS REQUIREMENTS OF VIBRIO FETUS

(L. C. Card No. Mic 58-3924)

Edward M. Kiggins, Ph.D.
The University of Connecticut, 1958

The optimum gaseous environment for growth of Vibrio fetus on blood agar was provided by an atmosphere consisting of 5 per cent oxygen and 10 per cent carbon dioxide, either under partial vacuum, or adjusted to 96 per cent of atmospheric pressure by adding hydrogen or nitrogen. Four of the 34 strains produced hydrogenase but grew only slightly better in an atmosphere containing hydrogen. Reduced oxygen content of the gaseous environment increased the amount of catalase released by V. fetus but did not cause catalase negative vibrios to become catalase positive. Because hydrogen was not essential for the growth of V. fetus, its use increased growth only slightly for a small number of strains, and because of its danger, hydrogen is not recommended for incorporation in the gaseous atmosphere used for growing V. fetus.

Studies on the metabolic activities of V. fetus using a Warburg apparatus showed that the common carbohydrates were not oxidized and further, with the exception of pyruvate oxidation, the Embden-Meyerhof glycolytic scheme was not operative. However, all the compounds of the tricarboxylic acid cycle were oxidized. Of the 23 amino acids tried, there was oxygen uptake only with glutamic acid, glutamine, aspartic acid, asparagine, proline and cysteine. Acetate was the only fatty acid oxidized. It would appear that V. fetus can obtain energy only from compounds of the tricarboxylic acid cycle or compounds which can be easily introduced into the cycle.

Semi-fluid thiol, thioglycolate and broth #73 were equal in their ability to support small numbers of V. fetus. Blood agar or thiol agar with 5 per cent blood were the solid media of choice. Thiol agar alone was superior to thioglycolate or Albimi brucella agar. When added to a basal medium defibrinated blood gave the best stimulation of growth, followed by hemolyzed blood and then serum.

V. fetus grew in a casein hydrolysate medium and also on a medium containing proteose peptone, sodium chloride and agar. All attempts to substitute a synthetic medium for the casein hydrolysate or the proteose peptone were unsuccessful. Microfilm $2.00; Xerox $3.00. 54 pages.

A STUDY OF BACTERIOPHAGE VIII-113 SPECIFIC FOR FLAGELLATED SALMONELLAE

(L. C. Card No. Mic 58-5291)

Sheldon A. London, Ph.D.
University of Delaware, 1958

Supervisor: W. Robert A. Bailey

The usual mechanism of attachment of bacteriophage to bacterial cells involves complementary chemical configurations located on the phage tail, and in association with the somatic antigenic structures of the host. The results obtained in this investigation indicate that adsorption of H phage VIII-113 differs from this mechanism by virtue

of the requirement for flagellated bacteria. Certain experiments suggested that the receptor sites for the phage are located on some structure associated with the flagella. It was proposed that this structure is in some manner connected with the basal granule. It was also observed that treatment with specific flagellar antisera could block the phage adsorption. By using chemical reagents specific for particular biochemical groups, carboxyl groups on the phage and amino (or substituted amino) groups on the bacterium were implicated as comprising the receptor sites. The pH stability and the filterability of this phage were noted. Exposure of Salmonella typhosa str. H901 to H phage VIII-113 resulted in secondary growth which appeared to be lysogenic for this phage. Inoculation of this growth into semi-solid agar resulted in the formation of an unusual pattern consisting of flagellated, but non-motile "trail" colonies and also swarm cells. An explanation of this phenomenon was proposed.

Microfilm $2.00; Xerox $5.20. 103 pages.

STUDIES ON THE PHYSIOLOGY AND LIPIDS OF A THERMOPHILIC SPOREFORMING BACTERIUM

(L. C. Card No. Mic 58-3982)

Sterling Krueger Long, Ph.D.
The University of Texas, 1958

Supervisor: Dr. O. B. Williams

Methods were developed for obtaining large quantities of spores and vegetative cells of a facultatively thermophilic strain of Bacillus stearothermophilus at incubation temperatures of 37 C and 55 C. Aeration of broth cultures at 37 C resulted in increased vegetative growth and sporeformation. The same conditions were unsuitable for growth and sporeformation at 55 C. Increased surface:volume ratios of the cultures permitted good vegetative growth and sporeformation at the latter temperature. Techniques for obtaining cell-free spore preparations were devised.

Determinations were made upon the quantities and types of lipids present in spores and vegetative cells produced at both temperatures to estimate the possible importance of these materials to heat resistance and thermophily.

Ether extraction of intact spores demonstrated the presence of considerable quantities of lipids on or near the surfaces of both types of spores. Removal of this lipid had no demonstrable effect upon acid-fastness, Sudanstainability, or heat resistance of either type of spore.

The viability of spores was unaltered by extraction which suggests that these lipids were obtained from the spore surfaces. Possible sources of these lipids may be the components of the medium or lytic products of the culture. The lipids may become associated with the spores by adsorption.

Extraction of cleansed ground spores yielded similar quantities of lipids for both types of spores. Approximately twice as much lipid was obtained from 37 C vegetative cells as from spores.

The lipids of 37 C spores were higher in phospholipid content than 55 C spores, while those of 37 C vegetative cells constituted almost 50 per cent of the total lipid.

Iodine number determinations indicate a greater unsaturation of 55 C spore lipids than those of 37 C spores and cells.

Paper chromatographic identification of the fatty acids of spore and cell lipids were unsuccessful although their chromatographic behavior suggests that they may be of 18 carbon, or greater, chain length.

Chemical and chromatographic analysis of phospholipid failed to reveal the presence of cephalin or sphingomyelin. It is suggested that the phospholipids of this organism may be lecithin or phosphatidic acids.

Ergosterol and cholesterol were uniformly absent from all lipids.

No correlation between lipid content and heat resistance or thermophily was established.

Microfilm $2.00; Xerox $5.00. 97 pages.

STUDIES ON THE ORIGIN OF INDUCED MUTANTS IN BACTERIA

(L. C. Card No. Mic 58-3987)

Thomas Stull Matney, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Orville Wyss

The origin of ultraviolet induced high level (1 mg per ml) streptomycin resistant mutants was followed in Escherichia coli B/r populations. Highly quantitative procedures for mutation analysis were developed through the use of membrane filters which served as vehicles for the transfer of positionally fixed bacterial populations from one environment to another.

Large numbers of mutations were induced in log phase populations by doses of UV so small that there was no measurable decrease in the number of viable cells following irradiation. These mutational processes could be photoreversed for a short period of time following ultraviolet treatment.

The length of post-radiation incubation required for the phenotypic expression of all of the induced mutants was found to be proportional to the amount of inducing ultraviolet light.

The two types of high level streptomycin resistant mutants commonly encountered, i.e., the streptomycin resistant type (Sr) and the streptomycin dependent type (Sd), could be distinguished easily on the basis of their colony size and were scored separately.

When populations containing multinuclear cells were treated with ultraviolet, a recessive mutation was induced at the high level streptomycin resistant locus of one of the nuclei in some of the cells. These induced heterokaryons were shown to recover from the UV and initiate growth at the same time as the bulk of the irradiation surviving population, presumably under the influence of the dominant nuclei. Evidence was obtained which indicated that these potential mutant cells underwent segregation at the same time the bulk of the irradiation surviving population accomplished its first post-irradiation division. The segregated mutant cells did not resume division until after completing their phenotypic expression.

When the same type of mutations were induced in uninuclear cells, no evidence for segregation was obtained

and the mutant cells did not initiate cell division until some time after becoming phenotypically expressed.

The increase in the overall delayed mutant expression following large doses of ultraviolet seemed primarily attributable to a prolonging of the time required for the mutant allele (segregated) to effect the phenotypic change.

The number of cell divisions accomplished by the bulk of the irradiation surviving population during the period of delayed mutant expression bore no causal relation to the origin of streptomycin resistant mutants.

Microfilm $2.00; Xerox $3.80. 68 pages.

CARBON DIOXIDE ACTIVATION IN THE PYRUVATE CLASTIC SYSTEM OF CLOSTRIDIUM BUTYRICUM

(L. C. Card No. Mic 58-5464)

Robert Paul Mortlock, Ph.D.
University of Illinois, 1958

In the present study of the phosphoroclastic system of Clostridium butyricum acetyl coenzyme A was established as an intermediate in acetyl phosphate formation from pyruvate. In addition to the known cofactors, manganous ion was found to stimulate the carbon dioxide-pyruvate exchange reaction. Although $NaHC^{14}O_3$ exchanges with pyruvate at a very rapid rate, acetyl-1-C-14 coenzyme A was incorporated into pyruvate only in extremely small amounts. Coenzyme A stimulated the exchange reaction in catalytic amounts but inhibited exchange when added in excessive amounts. This inhibition of the exchange reaction by a slight excess of coenzyme A was partially overcome by an increase in the $NaHC^{14}O_3$ concentration. Conversely, acetyl phosphate formation from pyruvate was inhibited by a carbon dioxide atmosphere and this inhibition was partially overcome by an increase in the coenzyme A concentration. Using a phosphate-free extract, carbon dioxide-pyruvate exchange occurred if either phosphate, arsenate or dihydrolipoic acid were added in substrate amounts, or if coenzyme A was added in catalytic amounts. These compounds all function as acetyl acceptors when incubated with cell free extract and pyruvate.

When the extract was incubated with pyruvate and acetaldehyde small amounts of acetoin were formed. Acetoin formation was inhibited by electron accepting dyes but was stimulated in dowex treated extract by the addition of coenzyme A and diphosphothiamine in catalytic amounts. Potassium ferricyanide was reduced when incubated with extract and pyruvate. Using dowex treated extract this reduction was stimulated by the addition of diphosphothiamine and very slightly stimulated by the addition of coenzyme A.

Ethanol fractionation of the carbon dioxide-pyruvate exchange reaction at pH 6.5 resulted in 5-10 fold purification. When ethanol fractionation was carried out at a pH of 4.0, two fractions were obtained which were partially resolved for exchange activity. The first fraction precipitated from 0-9 volume per cent ethanol whereas the second fraction precipitated from 32-43 volume per cent ethanol. These same fractions were also partially resolved for acetoin formation from pyruvate and acetaldehyde as well as for dye reduction from pyruvate. The second fraction contained a high concentration of bound diphosphothiamine whereas the first fraction contained a low concentration. These data indicate that in the clastic system of Cl. butyricum pyruvate is split to yield aldehyde and carbonyl fragments and that coenzyme A, diphosphothiamine, manganous ion and two heat labile fractions are required for such a split to occur.

When acetyl phosphate and carbon dioxide were incubated with the crude extract very small amounts of pyruvate were formed, indicating a reversibility of the clastic system. Pyruvate formation was stimulated by the addition of sodium hydrosulfite which served as an electron source for the reversal of the oxidative step. Small amounts of pyruvate were also synthesized from acetate, carbon dioxide and hydrosulfite. Pyruvate formation from acetate is not believed to occur via a reversal of the normal clastic system and was stimulated by the addition of substrate quantities of cytidine triphosphate.

As a working hypothesis for future study of the clastic system a mechanism was postulated which involved a carbonyl-coenzyme A-enzyme complex as an activated form of carbon dioxide.

Microfilm $2.00; Xerox $4.60. 86 pages.

THE NUTRITION AND PHYSIOLOGY OF PSEUDOMONAS FRAGI

(L. C. Card No. Mic 58-3928)

Joseph Nunes Pereira, Ph.D.
The University of Connecticut, 1958

Nutritional studies. Eighteen of the 62 carbon compounds studied supported good growth of at least one of the 6 test strains of Pseudomonas fragi. These compounds included glucose, ribose, gluconolactone, glycerol, amino acids, and metabolic intermediates related to the tricarboxylic acid cycle and glucose dissimilation. The presence of the Krebs cycle is indicated by the utilization of all intermediates tested. The utilization of ribose and gluconolactone is evidence for the existence of a system of glucose dissimilation alternate to the Embden-Meyerhof-Parnas scheme. This conclusion is substantiated by the results of manometric experiments.

The formation of biacetyl in cultures in which fumarate, malate, oxalacetate, and pyruvate were the sole sources of carbon is reported and may represent an accessory mechanism.

Glycerol was the only polyhydric alcohol which could support good growth of the test strains. Fatty acids, monohydric alcohols, and sodium bicarbonate were not suitable carbon sources.

Of the thirty nitrogen compounds studied, 28 were suitable nitrogen sources. Arginine hydrochloride, histidine hydrochloride, glutamic acid, and alanine could elicit good growth responses when supplied as sole source of both carbon and nitrogen.

Fruity aroma production was detected in all cultures in which alanine, leucine, or glutamic acid was the carbon source or in which threonine was the nitrogen source. Manometric studies indicated that DL-alanine, L-glutamate, L-leucine, and DL-threonine were oxidized to 52.6, 20.7, 2.9, and 12.5 per cent of completion.

These data indicate that the nutrition of P. fragi is

similar to that of other pseudomonads in its ability to grow in the absence of exogenous vitamins when an organic carbon compound and an inorganic nitrogen compound are provided.

Aroma studies. Paper chromatography of derivatives of compounds present in steam distillates of milk cultures of P. fragi revealed the presence of formic, acetic, propionic, butyric, and isovaleric acids after 2 weeks incubation. Ethanol was detected after the cultures were incubated for 4 weeks at 8 C. Esters were not detected in these cultures. A study of various additives to a basal milk medium indicated that ethanol was the limiting factor in aroma production since all cultures to which ethanol had been added developed a strong, characteristic aroma. Paper chromatography of the hydroxamic acid derivatives of esters from steam distillates of such cultures indicated that the ethyl esters of formic, acetic, propionic, and isovaleric acids were present. Ethyl isovalerate was present in greatest concentration. The esterification did not occur spontaneously in the absence of cells of P. fragi and methanol could not replace ethanol in the esterification reaction.

Several lines of investigation for future work are suggested. The phenomenon of ester formation by bacteria is reviewed.

The results of the aroma studies show that the ethyl esters of formic, acetic, propionic, and isovaleric acids are responsible for the fruity aroma produced in dairy products by P. fragi.

Microfilm $2.00; Xerox $3.00. 52 pages.

GLYCINE CLEAVAGE AND ONE-CARBON TRANSFER IN ACETATE FORMATION BY DIPLOCOCCUS GLYCINOPHILUS AND CLOSTRIDIUM ACIDI-URICI

(L. C. Card No. Mic 58-5486)

Richard Douglas Sagers, Ph.D.
University of Illinois, 1958

These studies concern the reactions forming acetate from glycine, serine, pyruvate, formate, and CO_2 by Diplococcus glycinophilus and Clostridium acidi-urici. The reactions observed, while on the main energy yielding pathways of these organisms appear to be of more general occurrence and significance.

The methods employed are primarily isotopic tracer, spectrophotometric, and chromatographic measurements with Hughes press cell extracts after fractionation or cofactor removal.

C. acidi-urici converts xanthine to formiminoglycine in non-energy yielding steps, and on to acetate, CO_2 and NH_3 with coupled energy release by steps in which the formimino carbon (purine C_8), via formimino tetrahydrofolate (THF-CH=NH), as shown by Sagers et al, is reduced and converted principally to acetate methyl. Glycine C_1 and C_2 (purine C_4 and C_5) respectively are converted to CO_2 and acetate carboxyl. The formimino THF-CH=NH is alternatively converted to formate with esterification of orthophosphate into ATP, as demonstrated by Rabinowitz and Pricer. Cells and extracts of C. acidi-urici in the presence of external electron acceptors convert glycine to acetate, CO_2 and NH_3 with labeling in conformity with the above observations. The same enzymatic sequence and cofactor specificities occur in extracts of D. glycinophilus.

The central features of both pathways can be summarized as: (1) glycine cleavage in a THF-dependent, DPN-, pyridoxal phosphate-stimulated oxidation, with release of C_1 as CO_2; (2) transfer of glycine C_2 after carboxyl oxidation, to THF at the formaldehyde oxidation level forming hydroxymethyl-THF, which equilibrates with 5,10-methylene-THF. A TPN specific dehydrogenase converts methylene to methenyl-THF, initiating the reaction sequence for formate release and phosphate esterification, or alternatively in reactions without oxidation, the hydroxymethyl is transfered from THF to glycine to form serine. Serine is deaminated to pyruvate, which by oxidative decarboxylation yields acetate and CO_2. Glyoxylate is inert in these systems, and thus not an intermediate. The reaction sequence releasing the glycine amino group remains to be clarified. Formate and CO_2 are in rapid equilibration, and could be incorporated into acetate via the serine-forming reactions noted above, through formate activation and reversal of the methylene-THF dehydrogenase to form hydroxymethyl-THF. Microfilm $2.00; Xerox $4.00. 74 pages.

OXIDATIVE DEGRADATION PRODUCTS OF GLUCOSE AND CERTAIN ASPECTS OF THE CULTIVATION OF BACILLUS STEAROTHERMOPHILUS

(L. C. Card No. Mic 58-5098)

Benjamin Quinn Ward III, Ph.D.
The University of Texas, 1958

Supervisor: Dr. O. B. Williams

A series of experiments employing a complex medium indicated that for a strain of Bacillus stearothermophilus, 30 minute autoclave sterilization of a medium containing 0.35 per cent glucose and adjusted to pH values >6 - <9 was optimal. Glucose was not essential but could modify growth. In addition to the oxidative decomposition products (G), a second stimulatory factor (factors) seemed to reside in Basamine Busch.

In synthetic media, only the omission of cysteine allowed growth from a spore inoculum in the absence of GP. Methionine was the sulfur amino acid of choice. In the absence of lysine growth from spores was hastened by omission of GP. In the presence of GP, spore inocula produced active growth more rapidly than cell inocula if lysine, arginine, or alanine was omitted. In the presence of GP, no amino acid was absolutely essential although the absence of many was detrimental. Valine and serine were essential to the initiation of growth from spores in the absence of GP, but only the omission of valine allowed sporulation with GP. Only l-valine was effective. Alpha-ketoisovaleric acid could substitute for valine, but isobutyric acid could not.

Spore formation seemed unaffected by metallic ions. The presence of cobalt or manganese generally delayed the initiation of growth from spore inocula and lowered growth maxima. Iron, calcium, and magnesium concentrations of 5×10^{-6} seemed optimal. The suggestion of a chelating action for GP was not found improbable.

In the presence of GP experimental evidence suggested

that sporulation tendencies of cultures reflect an overall balance of the germinating stimulus of valine, the sporogenic influence of leucine, and the moderating tendencies of isoleucine, threonine, and serine.

The spent media of lysed cultures seemingly contained a lytic principle. The possibility of phage lysis was not denied, and the possibilities in general were not pursued.

Certain results offered the possibility of sulfhydril transfer function for GP, but more extensive albeit indirect evidence, including chromatographic, suggested a GP role in transaminations.

The author concludes that thermophilic forms are in most respects quite commonplace. Generalities based upon a disregard for differences between glucose and GP are questioned, as is the applicability of results based upon GP rather than glucose as it is known to occur in nature.

Microfilm $2.65; Xerox $9.20. 201 pages.

BIOLOGY — GENETICS

SINGLE GENE HETEROSIS ASSOCIATED WITH A SECOND CHROMOSOME RECESSIVE LETHAL IN DROSOPHILA MELANOGASTER

(L. C. Card No. Mic 58-3181)

Terumi Mukai, Ph.D.
Purdue University, 1958

Major Professor: Allen B. Burdick

A clear demonstration of single gene heterosis for viability associated with a second chromosome recessive lethal in Drosophila melanogaster is described in this thesis.

In a case of superviability of heterozygotes, the proof of single gene heterosis must rest on the elimination of the contribution of (a) the genetic background and (b) specific interaction between the genetic background and the gene in question toward the observed superviability. The former can be achieved by tracing the frequency of lethal heterozygotes under random mating generation after generation because the genetic background becomes equalized for the two kinds of flies ($\underline{1}/+$ and $+/+$) by crossing over and random mating if the lethal is not contained within an inverted segment. The latter can be achieved by testing the degree of heterosis in different genetic backgrounds.

The lethal gene is located at about 55 on the second chromosome and is not associated with any crossing over inhibition. Four populations were established, the frequencies of lethal heterozygotes in the starting generation being 1 in Populations 1 and 2, and 0.05 in Populations 3 and 4. The genetic backgrounds of Populations 1 and 3 were the same and those of Populations 2 and 4 were the same. The populations were established and tested at different times but were propagated under the same schedule and density. The four populations reached the same equilibrium point where the frequency of lethal heterozygotes is about 0.42, and this has been maintained for more than 300 generations.

Mathematical model was set up in reference to the analysis of the experimental results. As factors affecting the viability of flies, mating ability of males, m; number of eggs of females, f, sperm competitive ability, s; and zygotic viability, v; can be considered. m, f, s, and v are the relative values of lethal heterozygotes or lethal carrying sperm. The standards are of the wild-type and assumed 1.00.

In the equilibrium population, the following relation can be obtained:

$$v = \frac{[(1+s)(1-Q) + mQ]\ [2-Q(2-f)]}{(1-Q)\left[2(1-Q)ms + (1+s)\{f(1-Q) + Qmf\}\right]}$$

where Q is the equilibrium frequency of lethal heterozygotes.

With the above formula, the necessary and sufficient conditions for maintenance of lethal heterozygotes in the equilibrium population were obtained when only each factor and every two factor combination contribute to the maintenance of lethal heterozygotes respectively.

For convenience's sake, the average productivity of males and females of lethal heterozygotes (p) were defined, although this does not have an exact meaning. In a dynamic population, the following relation can be obtained:

$$Q_n = \frac{2(1-p)Q_1p^{n-1}}{2(1-Q_1) + (3Q_1-2)p + 2p^{n-1}Q_1 - 3p^nQ_1}$$

where Q_i is the frequency of lethal heterozygotes in the i-th generation, and n is the number of generations.

In addition to these formulae, the other general formulae were also obtained.

The experimental results analysed mainly by the above two formulae indicate superviability of lethal heterozygotes, and other experimental results being added, the causes of superviability of lethal heterozygotes are attributable to higher fecundity of females and better mating ability of males in lethal heterozygotes caused by single gene heterosis.

Microfilm $2.00; Xerox $5.00. 99 pages.

ALTERNARIA LEAFSPOT DISEASE OF CUCURBITS

(L. C. Card No. Mic 58-3493)

Curtis Rukes Jackson, Ph.D.
The University of Florida, 1958

The Alternaria leafspot disease of cucurbits causes serious crop losses in the United States. Studies of the causal agent and its relation to cucurbit hosts in Florida were conducted over a period of 2 years.

The valid name of the causal organism is Alternaria cucumerina (E. & E.) J. A. Elliot. Invalid synonyms for this species are A. brassicae f. nigrescens Pegl., A. nigrescens (Pegl.) Neerg., and Macrosporium cucumerinum E. & E. An emendation to the extant descriptions of the pathogen was proposed. The host range of the pathogen included watermelon, muskmelon, cucumber 3 species of squash, bur gherkin, and several native plants.

The optimum temperatures for germination of conidia were between 20° and 28°C. Mycelial growth of 3 isolates in a liquid medium was significantly greater between 24° and 28°C than at higher or lower temperatures. Mycelial growth was greatest in medium which had an initial pH of 5.0.

The viability of conidia stored in vitro at constant temperatures of 8°, 28°, and 32°C was greater than 90 per cent after 255 days storage. Conidia were not recovered from infected leaves which were buried in a field plot during the fall and winter. Protected and exposed conidia rapidly became inviable when placed in a soil environment. Dormant mycelium in recovered leaf fragments resumed growth when environmental conditions became favorable and produced conidia which served as inoculum for new infections.

The host leaf epidermis was penetrated directly by germination hyphae of the fungus. Radial enlargement of lesions resulted from intercellular growth of the fungus beneath the epidermal tissue and subsequent intracellular growth in the palisade parenchyma and spongy parenchyma tissues. Microfilm $2.00; Xerox $4.40. 84 pages.

A SURVEY OF THE SOIL ALGAE OF TWO VEGETATION TYPES IN CENTRAL OKLAHOMA

(L. C. Card No. Mic 58-3883)

Dan Leroy Willson, Ph.D.
The University of Oklahoma, 1958

Major Professor: Dr. Glenn C. Couch

This investigation concerns the comparison of the seasonal algal flora in the upper one-half inch of soil collected from two black jack-post oak forests and two tall-grass prairies in central Oklahoma.

Seasonal (fall-October, 1956; winter-January, 1957; spring-April, 1957; summer-July, 1957) surface samples were collected from twenty stations in each of the four plots. After removal of the mulch, the samples were placed in new paper sacks with a clean metal spatula which had been flamed with an alcohol burner. Portions of each sample, thoroughly mixed, were placed in sterile Petri dishes and moistened with sterile modified Bristol's solution containing pyrex distilled water. The cultures were incubated at a constant temperature (21° C.), relative humidity (60%), and illumination (150-300 f-c., 16 hours per day). Some sub-cultures were made with Bristol's two per cent agar.

A total of 82 species and varieties were identified; 35 blue-greens (Myxophyceae), 23 diatoms (Bacillariophyceae), 18 greens (Chlorophyceae), 5 yellow-greens (Xanthophyceae), and 1 euglenoid (Euglenophyceae). Thirty-six of these were found in all seasonal collections: 12 occurred only in the forests, 1 only in the prairies, and 23 were present in both vegetation types. The greatest number of species and varieties occurred in the forests. Of the 72 different kinds in forest soil samples, 24 were confined to that area as compared to 10 of the total of 58 species and varieties found in the prairies. Forty-eight were common to both vegetation types.

Only the occurrence of an organism, not the frequency, in a sample was recorded. The algae that occurred in 45-100 per cent of the soil samples per season were arbitrarily designated as "predominants". There were six predominants common to both vegetation types: Chlorococcum humicola (Naeg.) Rabh., Hantzschia amphioxys (Ehr.) Grun., Navicula mutica Kuetz., Nostoc muscorum Ag., Pinnularia borealis Ehr., and Plectonema nostocorum Born. Two predominants, Cylindrospermum licheniforme (Bory) Kuetz. and Scytonema hofmannii Ag., were from the forests only, and one, Lyngbya aestuarii (Mert.) Lieb., from the prairies only.

From the evidence in this study it appears that the seasonal variation in the number of species and varieties was primarily due to the occurrence of the sporadic representatives. Microfilm $2.00; Xerox $3.00. 52 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

CHEMISTRY, GENERAL

STUDY ON THE PLASTIC PROPERTIES OF COAL

(L. C. Card No. Mic 58-5476)

Emile Desire Pierron, Ph.D.
University of Illinois, 1958

The purpose of the study is to investigate by means of solvent extraction, the fundamental components of coal which are responsible for its plastic characteristics as determined by the Gieseler plastometer. The physical properties and chemical nature of such components may lead to methods which would be used to classify and compare coals with greater dependability.

To be able to obtain a better basis for comparing yield of extraction, physical properties and chemical constitution of the extracts and residues in regard to fluidity, two coals of approximately similar chemical analysis and similar plastic temperature characteristics, but of different maximum fluidities were chosen; they were an Illinois high volatile B, and an Eastern high volatile A. A portion of the Illinois sample was oxidized until the plastic characteristics were completely destroyed.

The three series were submitted to the same scheme of solvent extraction. The coals were extracted with pyridine, the pyridine extract with chloroform, and the chloroform extract with n-hexane.

The following studies were made on each coal and their subsequent extracts and residues: Ultimate analyses with atomic H/C and O/C ratios, X-ray scattering data, infrared spectra, determination of plastic characteristics by means of the Gieseler plastometer and hot stage microscope, relative thermal decomposition temperature ranges by means of Differential Thermal Analysis, and determination of molecular weight.

The relative degree of aliphaticity as indicated by the atomic H/C ratios was in accordance with the aliphaticity trend shown by X-ray scattering data and infrared studies.

On the basis of the three series of coal investigated by the described procedures and techniques the following conclusions have been drawn:

1. Pyridine extraction appears to separate from the coals tested, the components responsible for plastic behavior as measured by the Gieseler plastometer.

2. The yield of extract for each solvent appears to be proportional to the fluidities, as measured by the Gieseler plastometer.

3. In each series, as the progressive scheme of extraction is carried out, each extract showed a higher degree of aliphaticity, a lower melting point, a lower molecular weight, and a relatively constant thermal decomposition temperature range.

4. For each coal the pyridine, chloroform, and n-hexane extracts are similar to the corresponding extracts of the other coals studied.

5. The oxidized Illinois coal, in spite of showing no Gieseler fluidity, still yielded 13.6% of pyridine extract. The significance of this phenomenon is not yet known; nevertheless, it is tentatively interpreted as the possible inability of the Gieseler plastometer to detect very low fluidity. Microfilm $2.00; Xerox $4.40. 85 pages.

AUTOMATIC DERIVATIVE POTENTIOMETRIC AND SPECTROPHOTOMETRIC TITRATIONS IN NONAQUEOUS SOLVENTS

(L. C. Card No. Mic 58-5512)

Donald Arthur Vassallo, Ph.D.
University of Illinois, 1958

In recent years both automatic end point detection and nonaqueous titrimetry have received considerable attention in analytical chemistry. Manual methods of performing titrations in nonaqueous media have been the rule. Although the tedium of graphical plotting of titration curves was eliminated by recording instruments, these require strict synchronization between titrant addition and recorder. Automatic instruments which terminate titrations at a preset potential are at a disadvantage because the reproducibility of potentials in mixed solvents is not all that is desired.

This investigation shows that the use of automatic derivative end point detection, although not increasing the scope of nonaqueous titrimetry, has definite advantages for precise, rapid and accurate titrations. Two end point detection systems are shown to be useful with the derivative unit, potentiometric and spectrophotometric, and their characteristics are discussed.

Twenty-five dyes which function as indicators in acetone are described. The most useful ones, neutral red, thymol blue, thymolphthalein and azo violet are utilized in the titration of strong, moderate, weak and very weak acids, respectively. Various solid electrodes were also tested to find a simple and convenient electrode system which operated without requiring a pH meter or salt bridge.

An automatic method in which acids are titrated in acetone with tri-n-butylmethylammonium methoxide was developed. All titrations with the exception of the very weakly acidic phenols can be performed with the potentiometric electrode system Pt(10% Rh)-graphite. The relative strengths of the acids and the absolute electrode potentials are not important because the derivative titrations are automatically terminated at the inflection point of their titration curves. The spectrophotometric technique is the method of choice for very weak acids using azo violet as indicator. Thus the spectrophotometric and potentiometric methods compliment each other.

Both the spectrophotometric and potentiometric end point detection systems can be connected directly to the commercially available Sargent-Malmstadt automatic

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

titrator. The two systems are compared as to limitations, accuracy and reproducibility.

Titration of organic acidic materials as well as stronger acids are determined by the automatic methods. Carboxylic acids, sulfonamides, imides, some mercaptans, enols and phenols are titrated rapidly and accurately. Mixtures of sulfuric and hydrochloric or nitric acids can be directly titrated rapidly and accurately. The end point reproducibilities for all titrations are about 0.01 ml of titrant and a relative precision of 0.2% is realized if a total volume of about 5 ml of titrant is involved in each calculation.

Microfilm $2.00; Xerox $4.80. 92 pages.

CHEMISTRY, BIOLOGICAL

THE ROLE OF PROTEIN IN THE SYNTHESIS OF NUCLEIC ACID

(L. C. Card No. Mic 58-5388)

Arthur Ian Aronson, Ph.D.
University of Illinois, 1958

In an attempt to understand some of the interrelations of nucleic acid and protein during their synthesis, an examination of the role of amino acids in ribonucleic acid synthesis was undertaken. Even in the presence of an excess of chloramphenicol, an extremely effective inhibitor of protein synthesis, a small amount of amino-acid incorporation into the protein fraction occurred. This labelled protein was found to be related both kinetically and physically to ribonucleic acid. It was thus assumed that even in the presence of chloramphenicol, there was preferential synthesis of a protein fraction intimately related to ribonucleic acid. This postulate was confirmed by the isolation of an acid-soluble protein fraction with a specific activity three to four times that of the intact protoplast.

These proteins accounted for only about one-half the total incorporation. Other experiments suggested that the remainder represented synthesis of proteins unrelated to ribonucleic acid. In an attempt to eliminate this "non-specific" protein synthesis, very high concentrations of chloramphenicol were used. Contrary to expectations, a complete inhibition of amino-acid incorporation resulted. There was no effect on ribonucleic acid synthesis, however. In addition, it was found that there was no amino-acid requirement for ribonucleic acid synthesis at these very high levels of the antibiotic. This result suggested that a catalytic function for the amino acids was unlikely. It was therefore postulated that the high concentrations of chloramphenicol had completely inhibited a conversion of the ribonucleic acid polymer to ribonucleoprotein. The amino acids would therefore be serving a secondary role in ribonucleic acid synthesis.

Some of the so-called abnormal properties of the ribonucleic acid synthesized in the presence of a chloramphenicol were found to be consistent with this hypothesis. In particular, the degradation of a portion of the chloramphenicol ribonucleic acid following drug removal could be prevented by a short incubation in the presence of amino acids before the cells were resuspended in a basal medium. A similar unstable ribonucleic acid and the conversion to a stable form could be detected in normal cells.

Further experiments to attempt to confirm the formation of ribonucleoprotein following chloramphenicol removal were performed. A rapid incorporation of amino acids into the proteins of the high-speed pellet fraction (the location of most of the ribonucleic acid) occurred during this period. There was no concomitant incorporation into ribonucleic acid nor was this protein synthesis inhibited by analogues of ribonucleic acid precursors. These results suggested that ribonucleic acid synthesis was not required for the formation of this protein fraction.

It was still necessary to explain why chloramphenicol is such an effective inhibitor of general protein synthesis. It was found that the early incorporation of amino acids into protein occurred in the same site in the cell (the high-speed supernatant fraction) for both chloramphenicol inhibited and normal protoplasts. Only at later times was the incorporation channeled into the high-speed pellet under conditions of chloramphenicol inhibition. This shift in the site of synthetic activity coincides with the disappearance of two of the macromolecular components normally found in protoplast extracts. It is therefore assumed that the antibiotic has prevented the continued formation of these components which are essential for protein synthesis.

A more detailed pathway regarding the synthesis of ribonucleic acid (and ribonucleoprotein) is presented. A great many observations concerning ribonucleic acid synthesis and the effects of chloramphenicol are found to be consistent with this proposed scheme.

Microfilm $2.00; Xerox $6.80. 143 pages.

THE NITROGEN AND AMINO ACID COMPOSITION OF THREE SPECIES OF ANOPLOCEPHALID CESTODES: MONIEZIA EXPANSA, THYSANOSOMA ACTINIOIDES, AND CITTOTAENIA PERPLEXA

(L. C. Card No. Mic 58-3862)

James Wayne Campbell, Ph.D.
The University of Oklahoma, 1958

Major Professor: J. Teague Self

The nitrogen and amino acid composition of three species of anoplocephalid cestodes has been determined. The three species analyzed were, Moniezia expansa from the small intestine of sheep, Thysanosoma actinioides from the biliary passages and gall bladder of sheep, and Cittotaenia perplexa from the small intestine of cottontail rabbits. Total nitrogen, non-protein nitrogen, and protein nitrogen were determined by the Kjeldahl method. Non-protein carboxyl nitrogen and protein carboxyl nitrogen were determined according to the method of Van Slyke, MacFadyen, and Hamilton. The non-protein and protein fractions were separated with 80% ethanol. Amino acids in the non-protein and protein fractions were determined qualitatively by means of paper partition chromatography on buffered papers. The reaction of amino acids with ninhydrin was utilized as the general color reaction. Specific color reactions were also carried out on the papers. For comparative purposes, the nitrogen and amino acid

composition of Dugesia sp., a free-living planarian, was determined. To test the postulate that cestodes satisfy their nutritional amino acid requirements by direct absorption from the host's tissues, the amino acids in sheep bile, which are available to T. actinioides, were determined.

On the basis of fresh weight, M. expansa is distinct from T. actinioides and C. perplexa in its nitrogen content. T. actinioides and C. perplexa show significant similarities in the amount of nitrogen in the total nitrogen, non-protein carboxyl nitrogen, protein nitrogen, and protein carboxyl nitrogen fractions. This establishes a closer biochemical relationship between C. perplexa and T. actinioides than exists between either of these species and M. expansa. Each species forms a more or less distinct group in the amount of nitrogen in the non-protein fraction. This is suggested as representing a specific nitrogen turnover rate for each species. Each species is also distinct in its percentage of solid matter. The percentage of this solid matter which is protein (protein carboxyl nitrogen X 6.25) is higher for T. actinioides than for the intestinal forms. This is attributed to differences in the availability of carbohydrate in the bile and intestinal environments. The protein amino acids are qualitatively identical for all three species. Differences were found in the amino acids of the non-protein fractions. The most significant of these differences is the presence of gamma-aminobutyric acid in the non-protein fractions of the intestinal forms and its absence from the hepatic form. The present findings obviate postulating a direct absorption of amino acids by cestodes from the host's tissues, at least in the case of T. actinioides. Sheep bile was found to contain sufficient amino acids to satisfy the requirements of this species.

This is the first report of the non-alpha amino acids, beta-alanine, beta-aminoisobutyric acid and gamma-aminobutyric acid, in cestodes. Possible roles of these amino acids in the intermediary metabolism of cestodes are discussed. Microfilm $2.00; Xerox $4.20. 76 pages.

TOXICOLOGICAL STUDIES ON SUBSTITUTED-VINYL PHOSPHATE INSECTICIDES

(L. C. Card No. Mic 58-5340)

Paul Esch Gatterdam, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor John E. Casida

Intensive research on substituted-vinyl phosphates originated from the findings of workers in Germany and the United States that 0,0-dimethyl 1-carbomethoxy-1-propen-2-yl phosphate and 0,0-dimethyl 2,2-dichlorovinyl phosphate and similar compounds were highly active insecticides. The first of these, known as Phosdrin insecticide, has been developed and is now in commercial use. Studies reported here on the chemistry, toxicology, and residues of this substituted-vinyl phosphate were important in determining the conditions under which Phosdrin could be used without leaving hazardous residues and in establishing a residue tolerance by the Food and Drug Administration. These investigations utilized bioassay, antiesterase, radiotracer, spectrographic, and chromatographic determinations.

Phosdrin and many related substituted-vinyl phosphates were found to be mixtures of geometrical isomerides which could be separated on chromatographic columns. The major component in Phosdrin was found to be the fraction first eluted from the column (alpha) and the less stable isomeride. The alpha isomer was also the most active as an insecticide and anticholinesterase agent.

Preliminary studies with Phosdrin insecticide in plants indicated it had promise as a short residual systemic insecticide. Greenhouse studies reported here indicated that it offered the shortest residual protection of seven systemic and three contact insecticides tested on cabbage and peas whether applied on the foliage or in the soil. Foliage application to 14 vegetable crops in the field resulted in a 90% loss in two days and over 99% loss in four days based on anticholinesterase determinations. The loss from plants was essentially the same for both isomers, with the beta isomer persisting only slightly longer than the alpha, and application of insecticidal doses of technical Phosdrin resulted in near dissipation of both isomers due to volatilization and hydrolysis within two days following application.

Phosdrin insecticide is an effective economic poison for the control of several important forage pests. Tolerances established by the Food and Drug Administration for forage crops are based on the highest levels of insecticidal residues that can be fed to cattle without contamination of milk or meat. Feeding studies were initiated to determine the residues and the toxicity associated with feeding Phosdrin insecticide to dairy cattle. Three cows each were fed for 12 weeks on encapsulated Phosdrin insecticide at levels of 0, 0.026, 0.13, and 0.52 mgm. per kgm. per day. Only the higher two levels caused marked cholinesterase depression and possibly less weight gain and daily dry matter intake. Calves fed milk fortified with Phosdrin insecticide at dosage levels comparable to the cows showed similar cholinesterase depression curves and when treatment was discontinued they recovered their blood cholinesterase activity within three to four weeks. Using an anticholinesterase method sensitive to 0.03 p.p.m. of Phosdrin, no toxic residues were found in milk, fat, or tissue samples at all levels which were tolerated by the cows without phosphate poisoning symptoms. Two cows fed radioactive Phosdrin confirmed the lack of significant residues in milk and tissues. Phosdrin insecticide was rapidly detoxified and excreted as non-toxic dimethyl phosphoric acid.

Column pure alpha fractions from 23 substituted-vinyl phosphates were compared as to alkaline stability, anticholinesterase activity, and toxicity. There appears to be no direct correlation between stability, toxicity to rats and flies, and antiesterase activity. Many substituents about the vinyl grouping were found to yield quite high insecticidal activity.

Studies with 23 amino acids for efficiency in catalyzing the hydrolysis of alpha-Phosdrin, indicated that the most active were those with an imino rather than an amino nitrogen (i.e. proline and hydroxyproline). Of the 32 remaining chemicals tested, the pyridine aldoxime methiodides were the most active catalysts for alpha-Phosdrin hydrolysis. The pyridine aldoxime methiodides were more effective catalysts than any of the amino acids at physiological hydrogen ion concentrations.

Microfilm $2.00; Xerox $3.80. 67 pages.

STUDIES ON IMPROVED NUTRITION DUE TO ANTIBIOTICS

(L. C. Card No. Mic 58-5352)

James Donald Jones, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Carl A. Baumann

Attention was concentrated on three phenomena pertaining to the mode of action of antibiotics in nutrition: possible changes in the intestinal weight of chicks with associated alterations in permeability of the intestine; the metabolism of vitamin A in rats as affected by antibiotics; and the action of sorbitol and penicillin in sparing thiamine in diets varying in fat.

Both in the presence and absence of antibiotics there was a marked decrease in the relative intestinal weight of chicks fed a semi-purified diet as the body weight of the chick increased from 50 to 300 gm. In some experiments antibiotics stimulated growth and decreased the relative intestinal weight and/or increased the permeability of the intestine. These effects were not consistent and the overall conclusion from a long series of experiments was that none of these changes necessarily followed the ingestion of antibiotics. Although aureomycin and penicillin frequently decreased the intestinal weights of chicks, it is suggested that a decrease in relative intestinal weight may be a reflection of increased body growth rather than a cause of it.

To test the hypothesis that antibiotics act by preventing the formation of toxic amines, indole, skatole, and a series of compounds that could yield amines were fed to chicks with and without antibiotics. Neither indole nor skatole exhibited a consistent effect on growth, intestinal permeability, or intestinal weight after 5 days on the diets either in the presence or absence of aureomycin. Although high levels of single amino acids or of choline depressed growth, the chicks did not respond consistently to antibiotics on these diets. The results do not suggest that the prevention of "amine toxicity" is a major means by which dietary antibiotics stimulate growth. If such a factor exists, it would seem to be other than indole, skatole, or amines derived from choline, lysine, leucine, tyrosine, or tryptophan.

The distribution of free and esterified vitamin A was determined in male rats fed a semi-purified diet and various sources of vitamin A plus or minus antibiotics. The vitamin A found in the liver and kidney of rats on all diets used was mainly in the esterified form while the blood vitamin A of the rats receiving A-alcohol, carotene, or haliver liver oil was mainly in the alcohol form. Penicillin and aureomycin appeared to increase the amount of vitamin A in the body when the dietary source was carotene. They were without effect when the source was vitamin A-alcohol or natural esters. When the vitamin was fed as the acetate, abnormal amounts of vitamin A-ester appeared in the blood. These amounts of ester were lowered significantly when penicillin or aureomycin was present in the diet. Thus the antibiotics tended to favor a normal distribution of the various forms of vitamin A in blood.

Penicillin, sorbitol, or both in combination were added to diets varying in carbohydrate and fat but lacking in thiamine, and the effectiveness of the additives was determined on the growth of rats. Either sorbitol or penicillin consistently increased the growth and survival of thiamine-deficient rats at the various levels of fat and carbohydrate, the magnitude of the growth increase being greatest when the need for thiamine was reduced, viz., on high fat diets. A supplementary action of penicillin on the effectiveness of sorbitol was noted after longer intervals on the diets. The results suggest that penicillin and sorbitol act in a similar manner, probably by increasing the intestinal synthesis of thiamine. Microfilm $2.00; Xerox $6.60. 138 pages.

THE METABOLIC FATE OF QUERCETIN IN RATS

(L. C. Card No. Mic 58-3872)

Andrew George Kallianos, Ph.D.
The University of Oklahoma, 1958

Major Professor: Dr. S. H. Wender

Two-dimensional chromatograms of the ether extracts of the lyophilized gastrointestinal organs of rats which had been force-fed radioactive quercetin indicate that this flavonol is degraded quite rapidly in the stomach of the rat. The paper chromatograms were sprayed with diazotized sulfanilic acid to detect phenolic compounds. Administration of radioactive quercetin to rats which had been maintained on a normal synthetic diet with complete vitamin fortification and to other rats which had been maintained on a synthetic diet devoid of riboflavin, resulted in the appearance of five radioactive spots of phenolic character in the ether extracts of the gastrointestinal organs and of the feces.

One of the radioactive spots which was present on the chromatograms of the gastrointestinal organs of every rat studied was 3,4-dihydroxybenzoic acid, according to chromatographic evidence. This was confirmed on rats fed randomly labeled quercetin and on rats fed quercetin-2-C^{14}. Phloroglucinol and phloroglucinol carboxylic acid have been discovered in the ether extracts of the stomach of the rat. Until the present study the metabolic products of quercetin which have been identified appear to have originated from that portion of the quercetin molecule containing the catechol nucleus. The γ-pyrone portion of the quercetin molecule had not been found.

Two other radioactive phenolic compounds which were found have been identified tentatively as 3,4-dihydroxyphenylacetic acid and homovanillic acid. The former compound was found in the combined ether extracts of the gastrointestinal organs of rats fed quercetin-2-C^{14}. The spot corresponding to the latter compound was present in the ether extracts of the feces. The exact position, size, and shape of each radioactive spot on the paper were determined by making radioautograms of the two-dimensional chromatograms.

Preliminary experiments have been undertaken on the degradation of quercetin by various enzyme preparations. Thus far both phloroglucinol and phloroglucinol carboxylic acid have been identified by two-dimensional chromatography of the products obtained by the degradation of quercetin by gastric mucin.

Microfilm $2.00; Xerox $3.00. 49 pages.

COMPOSITION OF ALGINIC ACID AND THE PREPARATION AND PROPERTIES OF ALGINAMIDES

(L. C. Card No. Mic 58-3171)

Kenneth William Kirby, Ph.D.
Purdue University, 1958

Major Professor: Roy L. Whistler

Alginic acid from Macrocystis pyrifera under controlled conditions of hydrolysis in sulfuric acid is shown to contain D-mannuronic acid and L-guluronic acid. The acids were isolated as their lactones and further characterized as derivatives of their aric acids. In 0.5 N sulfuric acid at 95° the rate of destruction of L-guluronic acid is about twice that of D-mannuronic acid. Hydrolysis periods under these conditions for more than 10-12 hours would reduce the amount of L-guluronic acid so that detection would be difficult. Alginic acid is shown to contain in the original polysaccharide about 70% D-mannuronic acid and 26% L-guluronic acid.

Amides and N-substituted amides of alginic acid can be prepared in high yield by reaction of alginic acid esters with ammonia or primary amines. Amines used were ethyl-, n-propyl-, n-butyl-, allyl-, cyclohexyl-, benzyl-, glucamine, ethylenediamine and hydroxylamine. The hydrazide was also prepared. The use of these derivatives in amounts from 5 to 50 p.p.m. are effective for flocculation and clarification of metal-plating wastes such as those containing chromium, cadmium or nickel. Coal washing water and bentonite clay suspensions are also flocculated. The tolerance of the amides to barium, calcium, cadmium, cupric, mercuric, nickel, lead and phosphotungstate ions indicates that they are relatively insensitive and thus would be good flocculants for many ionic solutions. Amides showing the best flocculating properties are those prepared from ethylamine, n-propylamine, ethylenediamine and ammonia. Supporting evidence is given to the theory that linearity, large molecular weight and chain extension are necessary to have a good flocculant. Tolerance of amides for cations is shown to be dependent on the amount of carboxyl groups available except when a long side chain is present which then inhibits cross-linking of polymer chains and prevents precipitation. Microfilm $2.00; Xerox $3.00. 39 pages.

THE ACTION OF COLLAGENASE ON NATIVE COLLAGEN

(L. C. Card No. Mic 58-3104)

LeRoy Klein, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Burnham S. Walker

The purpose of the research described in this thesis was to determine if the carbohydrate present in collagen was attacked by collagenase, thus indicating whether collagenase was a proteinase or a specific carbohydrase. This in turn would indicate if the carbohydrate of collagen was responsible for the stability or insolubility of collagen.

Collagenase was obtained from culture filtrates of Clostridium histolyticum. A procedure was developed for the large scale production of crude collagenase. Ten liters of culture filtrate yielded 3.0-3.5 grams. The collagenase was assayed by gross observation of the degree of dissolution of collagen or by determining the per cent of nitrogen solubilized.

The collagenase was active over a pH range of 6.5-8.5 and was stable at pH 5.5-9.5. In thermal studies collagenase was stable at 45°C for ten minutes.

Inhibition studies showed that periodate, sodium citrate and sodium oxalate inhibited the action of collagenase. None of the various monosaccharides tested had any inhibitory effect upon collagenase. Unlike the inhibitory effect of salt on peptic activity, 1 M sodium chloride had no effect upon collagenase activity.

Various collagens (rat tendon, horse tendon, bovine cornea) and elastin were isolated and purified by extensive extractions with 0.2 M phosphate buffer (pH 7.4) at room temperature. The composition of hexosamine and hexuronic acid were each determined by two different methods and compared. There was no hexuronic acid present as determined by the carbazole method and only 0.08-0.12 per cent hexosamine. Thus it is unlikely that collagenase or elastase are mucolytic enzymes. Our method of purification of collagen did not decrease its stability or insolubility.

Collagen solubilized by acid, base, pepsin or collagen was assayed for free hexosamine, hexuronic acid and hydroxyproline in relation to the nitrogen solubilized. Neither acid, base, pepsin or collagenase digestion of purified collagen showed a release of free hexuronic acid or hexosamine. The small amount of hexosamine present was in a bound form and in a 1:1 ratio with hexuronic acid which was also in a bound form.

In order to determine if the chemical reactivity of the collagens was different, the three collagens were subjected to different concentrations of acid and base and the dissolution measured. Rat tail collagen was found to be more readily dissolved by acid or base than bovine or horse collagen. Differences in degree of dissolution were not related to differences in carbohydrate content or in histological organization. The effect of base on collagen was not inhibited by 1 M sodium chloride as was the effect of acid. In this respect proteolysis by collagenase resembles alkaline degradation of collagen.

The data indicate that hexosamine and hexuronic acid are not part of the collagen's structure and are not responsible for its stability or insolubility. Thus the mucopolysaccharides of the ground substance do not appear to be necessary for collagen at the intramolecular level or intermolecular level, for the binding of collagen molecules into fibrils. Microfilm $2.00; Xerox $6.40. 131 pages.

EQUILIBRIUM DIALYSIS STUDIES OF PURINE AND PYRIMIDINE BINDING TO RABBIT MYOFIBRILS

(L. C. Card No. Mic 58-5447)

David Edgar Leventhal, Ph.D.
University of Illinois, 1958

A central problem in muscle physiology is the nature of the interaction of ATP with the contractile proteins. That the adenosine moiety of ATP is somehow involved in the

mechanical response of muscle models has been realized for some time. Several workers have investigated the comparative effect of various purine and pyrimidine nucleotides on mechanical response. Blum (1955) obtained values for the apparent Michaelis-Menten constants $\bar{K}^{app}$ for the interaction of ATP, ITP and UTP with actomyosin. He proposed that the differences of the values found for the several nucleotides might be a reflection of the relative affinities of the purine or pyrimidine rings for the enzymatic site and that magnesium might be involved in ring binding.

In view of this proposal we have made a direct determination, using the method of equilibrium dialysis, of the binding of adenine, hypoxanthine and uracil to washed rabbit myofibrils, and of adenine to myosin and fibrous actin. The determinations have been carried-out in .044M KCl, .011M K-phosphate, .0005M KCN, pH 6.7-7.0 with the following results:

protein	purine or pyrimidine concentration in solution (moles/liter)		moles bound per 10^5 g. of protein
myofibrils	adenine	.00125	.41 ± .07
myofibrils	hypoxanthine	.00134	.27 ± .03
myofibrils	uracil	.00140	.11 ± .04
myofibrils	adenine	.00240	.77 ± .1
myofibrils	adenine(.01M Mg^{++})	.00247	.80 ± .1
myofibrils	adenine	.00250	.78 ± .06
myosin	adenine	.00250	.85 ± .1
fibrous actin	adenine	.00250	.81 ± .2

Determination of the binding of adenine to myofibrils as a function of adenine concentration led to rough determinations of the number of moles of adenine binding sites per 10^5 g. of myofibrils, n, and the association constant for the binding reaction, K:

$$n = 4.5\ (+2.5, -1.5)$$
$$K = 89\ (+40, -30)$$

Assuming adenine, uracil and hypoxanthine to be bound to the same myofibril sites

$$K_{adenine} : K_{uracil} : K_{hypoxanthine} = 3.9 : 1.0 : 2.3$$

These ratios may be compared with ratios obtained from Blum's data (Blum, 1955):

$$\bar{K}^{app}_{ATP} : \bar{K}^{app}_{UTP} : \bar{K}^{app}_{ITP} = 4.9 : 1.0 : 0.4$$

The binding data yield the ratio

$$K_{adenine,\ .01M\ Mg^{++}} / K_{adenine,\ zero\ Mg^{++}} = 1$$

whereas (Blum, 1955)

$$\bar{K}^{app}_{ATP,\ .001M\ Mg^{++}} / \bar{K}^{app}_{ATP,\ zero\ Mg^{++}} = 52$$

$K_{adenine}$ from the binding studies, 89, may be compared with the value for $\bar{K}^{app}_{ATP}/\bar{K}^{app}_{TPP}$, 126 (Blum, 1955; Friess and Morales, 1955), if certain assumptions about the free energy of binding are made.

Assuming that ATP is bound only at the adenine end, our figures lead to the conclusion that 12% of the muscle ATP is bound to myofibrils and 28% of the adenine binding sites are filled. Such bound ATP may be of significance in actomyosin dissociation and in plasticization of muscle models.

The presence of adenine binding sites on actin, as demonstrated here, suggests the possibility of simultaneous interaction of the adenine end of ATP with actin and the phosphate end of ATP with myosin in actomyosin and in the myofibril.

This investigation was supported by fellowships from the National Science Foundation and the Public Health Service. Microfilm $2.00; Xerox $3.00. 58 pages.

THE METABOLISM OF SOME CARBOHYDRATES METABOLICALLY RELATED TO L-XYLULOSE

(L. C. Card No. Mic 58-5276)

Donald Bruce McCormick, Ph.D.
Vanderbilt University, 1958

Supervisor: Dr. Oscar Touster

Evidence for the existence of a new pathway of carbohydrate metabolism in mammals has been evolved during the last few years. This pathway involves the following sequence of reactions: D-glucose → D-glucuronic acid → L-gulonic acid → L-xylulose → xylitol → D-xylulose-5-phosphate. The last-named compound, an intermediate in the pentose phosphate pathway, links the other intermediates to a major metabolic system. In some species, the L-gulonic acid is also converted to L-ascorbic acid. Additional work on this new pathway appeared necessary because the evidence for it had been obtained in part from limited enzymatic studies or from uncorrelated studies on different species.

C^{14}-Labeled D-glucose and L-gulonolactone are converted in vivo to L-xylulose, with the lactone serving as a more efficient precursor. The drug, chloretone, reported to increase the rate of conversion of D-glucose to urinary D-glucuronic acid, L-gulonic acid, and L-ascorbic acid, appeared to have a similar but much less marked effect on the conversion of D-glucose to urinary L-xylulose in the rat and in the guinea pig.

Tracer experiments in the rat and in the guinea pig substantiated enzymatic evidence for the position of xylitol in the pathway. Injected xylitol-1-C^{14}, like the D-ribose-1-C^{14} used as control, is extensively converted to liver glycogen with the isotopic pattern in the carbon chain to be expected from metabolism of xylitol via the pentose phosphate pathway. The administered xylitol was also converted rapidly to CO_2, and a small portion was excreted in the urine.

The metabolism of the other three pentitols was also studied by the isotopic technique. D-Arabitol-1-C^{14} is apparently inert in the rat and in the guinea pig, but L-arabitol, previously reported to occur in pentosuric urine, is oxidized in part to CO_2, and some of its C^{14} label is found in the liver glycogen. The labeling pattern was such as to preclude a direct conversion of the L-arabitol to glycogen via a single known pathway. Ribitol-1-C^{14} was efficiently converted to liver glycogen, the latter having a pattern of labeling reasonably consistent with the hypothesis

that most of the ribitol is metabolized via the pentose phosphate pathway. It is suggested that the pentitol is dehydrogenated to D-ribulose, which is then phosphorylated to D-ribulose-5-phosphate.

The general procedures for fractionation of urinary glucuronides were studied, as was the stability of the various glucuronide components. The glucuronide material of normal human urine was found, by ion-exchange chromatography, to consist of a considerable number of conjugates, rather than only a few present in relatively large amounts. Conventional methods for the fractionation of glucuronides from urine allow appreciable hydrolysis, making the isolation of some of the more labile (especially ester) types difficult. However, Bilirubin glucuronide was isolated and identified, and the significance of this compound was discussed in relation to the van den Bergh reaction.

Microfilm $2.00; Xerox $6.40. 133 pages.

EFFECTS OF CERTAIN PURINE INHIBITORS IN NORMAL AND NEOPLASTIC TISSUES

(L. C. Card No. Mic 58-5364)

Erin Colleen Moore, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor G. A. LePage

I. Introduction.

The importance of metabolic differences among tissues is discussed in relation to the chemotherapy of cancer.

II. In Vivo Sensitivity of Normal and Neoplastic Mouse Tissues to Azaserine. E. C. Moore and G. A. LePage, Cancer Research 17 804-808 (1957).

The inhibition of incorporation of glycine-2-C^{14} into purines by various doses of azaserine and of 6-diazo-5-oxo-L-norleucine (DON) was measured in a number of mouse tissues. The tissues were found to vary widely in their sensitivity to both drugs. Rapidly growing tissues were inhibited by lower doses of inhibitors. Most tissues, when inhibited by azaserine, accumulated formylglycinamide ribotide, but some also accumulated an unknown intermediate.

III. Experiments on the Binding of DON.

Ehrlich ascites tumor cells were incubated in vitro with glycine-2-C^{14} and DON. Incorporation of glycine into purines was partially inhibited during the first 15 minutes and completely inhibited thereafter. This suggested that, as is known to occur with azaserine, a binding reaction requiring a measurable time is necessary for inhibition. In vivo inhibition of de novo purine synthesis by DON in tumor-bearing mice lasted for over 15 hours, which also indicated binding.

IV. The Metabolism of 6-Thioguanine in Normal and Neoplastic Tissues. E. C. Moore and G. A. LePage. A manuscript to be submitted for publication.

Blood levels and tissue distribution of 6-thioguanine in mice were determined. The blood levels decreased by 90 per cent within 1 minute after intravenous injection. Between 1 minute and 15 minutes after intravenous injection of 6-thioguanine-8-C^{14} the radioactivity in lung, heart, blood, and kidney decreased while that in spleen, intestine, and ascites tumor cells increased.

Ion exchange chromatography was used to isolate metabolites of 6-thioguanine from various mouse and guinea pig tissues. Nucleotides of 6-thioguanine were the principle metabolites in Ehrlich ascites tumor, while approximately equal amounts of nucleotides and of 6-thiouric acid were found in mouse intestine and liver and in guinea pig intestine and bone marrow. The variation in the amounts of metabolites with time and with dose size were studied.

V. 6-Thioguanine Metabolism in a 6-Thioguanine-Resistant Tumor Line.

The metabolism of 6-thioguanine in a 6-thioguanine-resistant subline of the Ehrlich ascites tumor was compared with that in the sensitive parent tumor. The resistant tumor produced more 6-thiouric acid and less 6-thioguanine nucleotides than did the sensitive tumor.

Microfilm $2.00; Xerox $4.40. 84 pages.

COMPOUNDS FOR METABOLISM STUDIES: RADIOACTIVE AROMATIC AMINES AND THEIR POSSIBLE DETOXICANTS

(L. C. Card No. Mic 58-3503)

Marjorie Pauline Newell, Ph.D.
The University of Florida, 1958

The present investigation was undertaken to establish possible relationships between the physiological activity of a simple aromatic amine and the type and extent of detoxication that the compounds undergo in vivo.

Acetanilide has analgesic and antipyretic properties and also exerts a toxic effect. The compound detoxifies by deacetylation and hydroxylation followed by formation of glucuronides and ethereal sulfates. Substitution of the various positions of acetanilide affects the deacetylation of the compound in vitro. It was postulated that such substitution would affect the position and degree of hydroxylation which in turn might affect the physiological properties of the compounds.

The monochloro, ring-substituted acetanilides (4-, 3-, and 2-chloroacetanilides) were chosen to study the relationship of metabolism to the relative toxicity of the compounds in the animal body. The radioactive isotope, Chlorine-36, was chosen as the substituent so that it could also be used as a tracer in isotope dilution experiments.

The author previously prepared 2- and 4-chloroacetanilide-Cl-36. For this study, the third isomer, 3-chloroacetanilide-Cl-36 was prepared through direct chlorination of 3-nitrobenzenemercuric acetate. The 3-chloronitrobenzene-Cl-36 thus formed was reduced and acetylated. The postulated hydroxylated metabolites of each of the isomeric ring-substituted monochloroacetanilides were prepared for use as carrier compounds in inverse isotope dilution experiments.

The toxicity of 4-, 3-, and 2-chloroacetanilide was determined in C57bl/6 mice and in Sprague-Dawley rats. 4-Chloroacetanilide was the most toxic, 3-chloroacetanilide was next in toxicity, and 2-chloroacetanilide was the least toxic in both species.

Inverse isotope dilution was employed to identify the

deacetylated and hydroxylated metabolites of the three monochloroacetanilides in the urine of rats injected with the drugs. It was found that less than 5% of each compound was excreted unchanged. Deacetylation of the compounds in vivo follows inversely the pattern of toxicity of the drugs. The most toxic compound, 4-chloroacetanilide, is the least deacetylated; the isomer intermediate in toxicity is intermediate in extent of deacetylation; and the least toxic compound, 2-chloroacetanilide, undergoes the greatest deacetylation.

The amount of hydroxylation determined after acid hydrolysis of the acetyl, glucuronide, and ethereal sulfate moieties revealed that neither total nor para-hydroxylation follows the toxic pattern but that ortho-hydroxylation does follow the pattern of toxicity. ortho-Hydroxylation is greatest in the most toxic isomer, 4-chloroacetanilide; it is intermediate in 3-chloroacetanilide; and occurs to the least extent in the least toxic compound, 2-chloroacetanilide.

Qualitative enzymatic determination of individual hydroxy metabolites of 4-chloroacetanilide revealed that 4-chloro-2-hydroxyaniline and 4-chloro-2-hydroxyacetanilide were excreted in the urine unconjugated and as their glucuronides and ethereal sulfates. The hydroxy metabolites of 3-chloroacetanilide that were identified were 3-chloro-4-hydroxyacetanilide unconjugated and as the glucuronide and ethereal sulfate, unconjugated 3-chloro-4-hydroxyaniline and its ethereal sulfate; unconjugated 3-chloro-6-hydroxyacetanilide and its glucuronide, unconjugated 3-chloro-6-hydroxyaniline and its glucuronide. The hydroxy metabolites of 2-chloroacetanilide identified were unconjugated 2-chloro-4-hydroxyacetanilide, and its glucuronide and ethereal sulfate, the glucuronide and ethereal sulfate of 2-chloro-4-hydroxyaniline; the ethereal sulfate of 2-chloro-6-hydroxyacetanilide, the glucuronide and the ethereal sulfate of 2-chloro-6-hydroxyaniline.

Microfilm $2.20; Xerox $7.80. 168 pages.

THE METABOLISM OF INOSITOL

(L. C. Card No. Mic 58-3189)

Keith Erwin Richardson, Ph.D.
Purdue University, 1958

Major Professor: Bernard Axelrod

The ubiquitous existence of the B vitamin, myo-inositol, in higher plants and animals has been recognized for many years. Since its metabolic function in these tissues has not been fully established, an investigation of the anabolism and catabolism of this compound has been undertaken.

Introductory studies on the changes in the inositol content of corn, soybean, wheat, mung bean, cabbage and pea during germination and development showed an initial decrease in total inositol content, followed by an ultimate increase as the plants approached maturity. Since the decrease was not due to diffusion of inositol out of the plant through the roots, metabolism of inositol is indicated.

Inositol-C^{14} was readily synthesized by plant tissues placed in a $C^{14}O_2$ atmosphere. Detectable amounts were produced by 10 day old etiolated pea seedlings and ginkgo tree leaves. However, pea plants containing immature pea pods gave the highest yield, 0.8%, and were found to be a suitable tissue for the biosynthesis of randomly labeled inositol-C^{14}. Glucose-1-C^{14} and glucose-6-C^{14} were also incorporated into inositol-C^{14}.

$C^{14}O_2$ production was observed when tissue slices of 5 day old plants were incubated with inositol-C^{14}. Corn pollen was also capable of converting inositol-C^{14} to $C^{14}O_2$. Homogenates of plant tissue were inactive. In addition, significant activity was found in the hemicellulose and phospholipid fractions of 3 day corn coleoptile slices after incubation with inositol-C^{14}.

The inositol content in the blood of young chickens fed an inositol free diet did not differ significantly from those fed a normal diet, indicating that chickens (or their intestinal flora) can synthesize inositol.

The conversion of inositol to CO_2 and L-xylulose via glucuronic acid and L-gulonic acid by a soluble enzyme system from rat kidney reported by other workers has been substantiated in this investigation. However, the existence of an alternate pathway for the conversion of inositol to CO_2 is indicated. In contrast to the soluble pathway, this is a particulate enzyme system. Isotope dilution studies showed that it does not proceed via free glucuronic acid, L-gulonic acid, or L-xylulose. The two systems also differ in pH optima, the effect of inhibitors, and in their enzymatic stability. Glucose, myo-inosose-2 and inositol monophosphate are not free intermediates in either system.

Under the experimental conditions used, it appears that the particulate system is responsible for the formation of $C^{14}O_2$ from inositol-C^{14} in rat kidney homogenate. It is suggested that this is due to the presence of an unidentified competitive inhibitor of the supernatant system in rat kidney particulate material.

Microfilm $2.00; Xerox $4.00. 75 pages.

THE OCCURRENCE AND ISOLATION OF AN UNIDENTIFIED VOLATILE COMPOUND ASSOCIATED WITH ERYTHROCYTES

(L. C. Card No. Mic 58-5483)

Ralph Compton Robbins, Ph.D.
University of Illinois, 1958

A volatile compound has been discovered in the blood and tissues of several species of animals, e.g., cattle, sheep, swine, dogs, and poultry, which distills from slightly acidified blood and passes through 1 N acid, 1 N alkali, and 10 percent lead acetate solutions and complexes with diethylamine and copper. The compound was found to be associated with the protein moiety of the erythrocyte and is not dialyzable. Its occurrence in the blood of the animal appears to be related to metabolic processes, as it appears to fall with feeding and rise and disappear again with fasting. The observation was made that the compound appears to be present in greater concentrations in the erythrocytes which have a tendency to clump in storage containers and during heating in slightly acidic solutions. The compound is a clear liquid with an aromatic odor. It is soluble in diethyl ether and insoluble in water.

The compound has been isolated, using vapor phase fractionation, and work is in progress to complete its characterization. Microfilm $2.00; Xerox $4.60. 86 pages.

ACTION OF PURINE ANTIMETABOLITES ON NEOPLASTIC TISSUE

(L. C. Card No. Mic 58-5373)

Alan Clayton Sartorelli, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor G. A. LePage

I. THE DEVELOPMENT AND BIOCHEMICAL CHARACTERIZATION OF RESISTANCE TO AZASERINE IN A TA3 ASCITES CARCINOMA

A subline of the TA3 ascites carcinoma exhibiting resistance to azaserine was developed by consecutive passage of cells in mice treated with increasing doses of azaserine. The change was found to be stable and heritable.

A single dose of 0.2 mg./kg. of azaserine equally inhibited de novo purine synthesis, as measured by glycine-2-C^{14} incorporation, in resistant and sensitive cells for 3 hours. From this time on there was a more rapid recovery of the ability to synthesize purines de novo by cells of the resistant line as compared with the parent sensitive tumor. Concurrently with the difference in rate of regeneration of the de novo pathway, there was found a greater ability on the part of the resistant cells to utilize preformed purines for nucleic acid synthesis during the initial period of inhibition by azaserine.

II. INHIBITION OF ASCITES CELL GROWTH BY COMBINATIONS OF 6-THIOGUANINE AND AZASERINE

The Ehrlich ascites carcinoma, the Sarcoma 180 ascites, and the TA3 ascites carcinoma were found to be sensitive to combinations of azaserine and thioguanine. The Mecca lymphosarcoma in either solid or ascites form and the 6C3HED lymphosarcoma ascites proved to be relatively resistant. The most effective dose schedule tried was 0.2 mg./kg. azaserine plus 0.5 mg./kg. thioguanine administered twice daily beginning 24 hours after tumor implantation. After six days of this therapy, 50 per cent of mice transplanted with Ehrlich ascites carcinoma, 60 per cent of mice transplanted with Sarcoma 180 ascites and 23 per cent of mice transplanted with TA3 ascites carcinoma were found to be tumor-free. For maximum tumor inhibition thioguanine and azaserine had to be administered simultaneously, supporting the concept that the two drugs establish concurrent blocks of purine nucleotide synthesis.

III. METABOLIC EFFECTS OF 6-THIOGUANINE 1. STUDIES ON THIOGUANINE-RESISTANT AND -SENSITIVE EHRLICH ASCITES CELLS

A thioguanine-resistant subline of the Ehrlich ascites carcinoma was developed by passage of cells in mice treated with daily doses of 2 mg./kg. of thioguanine. The change was a stable and heritable one.

Both thioguanine-sensitive and -resistant tumor cells were capable of metabolizing the antimetabolite to the nucleotide form. However, the concentration of thioguanine and its nucleotide forms was kept at a relatively low level in resistant cells by the presence of more active thioguanine-catabolizing enzymes.

The thioguanine-resistant population was slightly more susceptible to combination therapy of azaserine and thioguanine as compared with the parent thioguanine-sensitive tumor. These results illustrate a case in which resistance to one agent may be circumvented by its use in combination with a second agent.

IV. METABOLIC EFFECTS OF 6-THIOGUANINE 2. IN VIVO AND IN VITRO BIOSYNTHESIS OF NUCLEIC ACID PURINES

The effects of 6-thioguanine on purine metabolism were investigated in ascites tumor cells. Experiments with isotopically labeled precursors of nucleic acid purines indicated that at least three different metabolic sites appeared to be involved in the inhibition produced by thioguanine. These include the following: the de novo purine synthetic pathway prior to the formation of α-N-formyl glycinamide ribotide; the utilization of preformed guanine; and the conversion of guanine to adenine.

Incorporation of precursors into nucleic acid purines was inhibited in both thioguanine-sensitive and -resistant Ehrlich ascites cells. The inhibition of the various pathways occurs to a lesser degree in the resistant tumor. This is correlated with the relatively smaller quantity of thioguanine which has been found present in the resistant ascites cells. Microfilm $2.00; Xerox $7.00. 147 pages.

A STUDY OF CERTAIN BLUE-FLUORESCENT POLYPHENOLS IN TOBACCO LEAVES, FLOWERS AND CIGARETTE SMOKE

(L. C. Card No. Mic 58-3884)

Chao-Hwa Yang, Ph.D.
The University of Oklahoma, 1958

Major Professor: S. H. Wender

Blue-fluorescent compounds present in tobacco have previously received relatively little attention. Many of them are phenolic in structure (possibly precursors of flavonoid compounds), and others are coumarins. To obtain fundamental, new information on these compounds, studies were undertaken involving the isolation, characterization, and identification of the blue-fluorescent compounds in the tobacco plant.

The existing methods of chromatographic and partition techniques have been applied, modified, and extended in the isolation and purification of the blue-fluorescent compounds. Four specific blue-fluorescent compounds were isolated in pure form from the alcoholic extracts of leaves and flowers of the One-Sucker tobacco plant. Two of them were identified as scopoletin and chlorogenic acid. The third blue-fluorescent compound was found to be a coumarin-glycoside, which upon hydrolysis with dilute mineral acid gave scopoletin, glucose and rhamnose. A tentative structure has been proposed for this glycoside: scopoletin-7-rhamnoglucoside.

The fourth blue-fluorescent compound has been characterized to be a "chlorogenic acid-like" depside by color tests, chromatographic R_f values, and by saponification. Its identity has, however, not been established. Also, three flavonoid glycosides in addition to isoquercitrin, rutin, and kaempferol-3-rhamnoglucoside were isolated from extract of flowers. The former have been partly characterized.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Tobacco plants grown at the Argonne National Laboratory in an atmosphere of radioactive carbon dioxide were extracted and the alcohol extracts fractionated on a cellulose powder column. The column fractions were purified further by mass paper chromatography to obtain the following radioactive compounds in pure form for planned metabolic studies: scopoletin, scopoletin-7-rhamnoglucoside, chlorogenic acid and the "chlorogenic acid-like" depside.

A method for the quantitative determination of polyphenols in a dry tobacco sample was developed. Each pure individual polyphenol obtained after extended paper chromatography was eluted from the final chromatogram and spectrophotometrically measured. This quantitative method was then used to measure the rutin content and scopoletin content in tobacco of 24 brands of cigarettes commonly used in the United States.

Scopoletin has been identified in tobacco of 29 brands of cigarettes commonly used in the United States. By using a smoking machine designed to simulate conditions of human smoking, the mainstream smoke from every cigarette sample tested also was found, for the first time, to contain scopoletin. Microfilm $2.00; Xerox $5.80. 116 pages.

CHEMISTRY, INORGANIC

THE ATTEMPTED SYNTHESIS OF 2,2'-BIPYRIMIDINE and ATTEMPTS TO ESTABLISH PERFORMANCE TESTS FOR INFRARED SPECTROPHOTOMETERS

(L. C. Card No. Mic 58-3145)

Edward Casimere Copelin, Ph.D.
Purdue University, 1958

Major Professor: M. G. Mellon

Part I. The synthesis of 2,2'-bipyrimidine was attempted at first by the means of reactions analogous to the preparation of 2,2'-bipyridine. The treatment of 2-chloropyrimidine with copper powder in a solvent of p-cymene as in an Ullman reaction was not successful due to the low reactivity of the halo group. The same method in a solvent of dimethylformamide resulted in the formation of 2-dimethylaminopyrimidine from a substitution of the more basic dimethylamino for the chloro group. The preparation of 2-chloro-5-nitropyrimidine, a compound having a more reactive chloro group, by chlorination of the sodium salt of 2-hydroxypyrimidine, by nitration of 2-chloropyrimidine, or by the diazotization of 2-amino-5-nitropyrimidine was also unsuccessful. Finally, the conversion of 2-cyanopyrimidine to the corresponding amidine did not appear to occur either by fusion with ammonium thiocyanate or by the Pinner amidine synthesis. It was thought possible that the amidine, if prepared, would condense with sodium nitromalonaldehyde to form 5-nitro-2,2'-bipyrimidine.

Part II. In order to establish the degree of photometric reproducibility that exists among infrared spectrophotometers, a series of performance tests was conducted on 8 Perkin-Elmer Model 21 Spectrophotometers located at 5 cooperating sites. The experiment was limited to one type of instrument owing to the difficulty among others, of specifying an effective spectral band width for different makes of spectrophotometers. A sealed isobutane gas sample circulated among the sites produced a decided decrease in the variability among instruments and pointed to a need for a more reproducible photometric standard. In addition, those instruments with photometric combs in a questionable condition yielded the highest and lowest measurements. The degree of reproducibility among them was found too low to consider a possible exchange of quantitative data such as molar absorbancy indexes among sites.

To compare the photometric reproducibility of spectrophotometers, the necessary requirements of a standard are: (1) reproducibility; (2) stability; (3) exhibition of optical properties of an actual sample; (4) simplicity in use; and (5) ease in calibration. A method has been developed to prepare polystyrene-coated sodium chloride plates. Tests have shown the short-term reproducibility of these plates when measured by the baseline density method to be very suitable. However, making 2 identical samples is a matter of chance, and the polystyrene films may craze with time. Microfilm $2.15; Xerox $7.60. 161 pages.

OBSERVATIONS ON THE RARE EARTHS: CHEMICAL AND ELECTROCHEMICAL STUDIES OF SOLUTIONS OF RARE EARTH METAL SALTS IN ANHYDROUS DIMETHYLFORMAMIDE

(L. C. Card No. Mic 58-5416)

Valentine David Galasyn, Ph.D.
University of Illinois, 1958

Solvated rare earth iodides, having the general formula $LnI_3 \cdot 8DMF$, have been prepared by the reaction between the appropriate hydrated rare earth acetate and acetyl iodide in a dimethylformamide medium (Ln represents La, Pr, Nd, Sm, and Gd, whereas DMF represents dimethylformamide). The reaction can be represented by the following equation:

$$Ln(C_2H_3O_2)_3 \cdot x\,H_2O + (3 + x)\,CH_3COI \xrightarrow{DMF}$$

$$LnI_3 \cdot 8DMF + 3(CH_3CO)_2O + xHC_2H_3O_2 + xHI$$

The desired product is precipitated from the clear solution of the reaction products by the addition of ether. Continued recrystallization from dimethylformamide is necessary to obtain a pure product.

The neodymium compound has also been prepared by the metathetical reaction between hydrated neodymium chloride and potassium iodide in a dimethylformamide medium. In this method, water is removed from the system by distillation of the benzene-water azeotrope from a mixture of the hydrated rare earth chloride, dimethylformamide, and benzene. The excess benzene is removed by distillation, and the resulting solution is then mixed with a dimethylformamide solution of potassium iodide. The insoluble potassium chloride that forms is removed by filtration, and the desired product is precipitated from the clear filtrate by the addition of ether.

These crystalline compounds are extremely hygroscopic and must be handled under anhydrous conditions. The melting point data suggest that bonding exists between

the dimethylformamide molecules and the rare earth cations.

The compound $Sm(C_2H_3O_2)_3 \cdot DMF$ has been prepared by distillation of the benzene-water azeotrope from a dimethylformamide solution of the hydrated acetate. This crystalline compound is not hygroscopic. This method of removing water shows promise as a generally applicable procedure for the preparation of a variety of anhydrous salts.

The absorption spectra of $PrI_3 \cdot 8DMF$, $NdI_3 \cdot 8DMF$, and $SmI_3 \cdot 8DMF$ in dimethylformamide have been obtained. These were compared with the absorption spectra of the corresponding rare earth perchlorates in aqueous solution. Slight displacements in wavelengths, alterations in absolute intensities for certain bands, and changes in resolutions of complex bands were observed. This suggests that a high degree of association exists between the rare earth cations and solvent molecules.

The solubilities of the solvated rare earth iodides in dimethylformamide have been determined quantitatively. The compounds are all highly soluble. The trend in solubilities could not be correlated with cationic radii.

Conductivity studies showed that these salts are moderately weak conductors in dimethylformamide. In concentrated solutions, the conductivities decrease in the series from lanthanum to gadolinium. This corresponds with decreasing cationic radius and increasing degree of cationic solvation.

Various electrolyses were carried out with dimethylformamide solutions of these salts in an attempt to obtain the free rare earth metals. A black cathode deposit was obtained during two electrolyses of solutions of $LaI_3 \cdot 8DMF$. Although the presence of lanthanum metal in these deposits was indicated, it could not be definitely proven. X-ray diffraction analysis was inconclusive.

The exact conditions under which the black deposit formed could not be reproduced again during subsequent electrolyses. The reasons for this are unknown. However, it is felt that the nature of the cathode surface is of prime importance in determining whether the deposit will form. If the exact conditions required are found, the black deposit should be obtainable again.

It appears that solvent decomposition during electrolysis rules out this system as a means of obtaining the pure rare earth metals in usable amounts.

Neodymium amalgams have been prepared by the electrolysis of dimethylformamide solutions of $NdI_3 \cdot 8DMF$, using a mercury pool cathode.

Microfilm $2.00; Xerox $5.20. 104 pages.

PART I: THE INTERACTION OF HEXACHLOROSMATE(IV) WITH BIS-(SALICYLAL) ETHYLENEDIIMINE
PART II: THE KINETICS OF THE ACID DISSOCIATION OF TRIS-(PYRIDINAL-n-PROPYLIMINE) IRON(II)

(L. C. Card No. Mic 58-3920)

Edward Augustine Healy, Ph.D.
The University of Connecticut, 1958

The reaction between the hexachlorosmate(IV) ion and bis-(salicylal)ethylenediimine has been investigated and the results constitute Part I of the dissertation. A mixture of products containing at least one blue and one red component was obtained upon heating a methanol-water solution of either the sodium or potassium salt of hexachlorosmate-(IV) and the ligand. Attempts to isolate crystalline products in good yield from this mixture were unsuccessful. A small amount of a pure compound was isolated and analyzed, however. The results of the analysis agreed with the formulation $[Os(enS_2)(H_2O)_2]Cl$ where enS_2 represents $[C_6H_5(O)CH = N(CH_2)_2N = CH(O)C_6H_5]^{-2}$. The very small amount of compound available prevented further investigation.

The kinetics of the acid dissociation of $[Fe(PPI)_3]^{+2}$ ‡ were examined in detail and the results are contained in Part II of the dissertation. In addition, the acid dissociation studies of $[Fe(bipy)_3]^{+2}$ were extended under conditions comparable to those used in the $[Fe(PPI)_3]^{+2}$ studies, and some quantitative rate data were obtained on the acid dissociation of $[Fe(PRI)_3]^{+2}$ ions, where R may equal methyl, ethyl, isopropyl, n-butyl, or α-dl-phenylethyl. Also, a fairly extensive study was made on the kinetics of the acid dissociation of $[Fe(PAQ)_2]^{+2}$. Qualitative observations were made of the dissociation rates of the iron(II) complexes derived from pyridine-2-aldehyde and some substituted primary aromatic amines. Finally, a qualitative observation was made of the behavior of $[Fe(GBzI)_3]^{+2}$ in acid solutions.

The dissociation rates were followed spectrophotometrically and found to be first order in complex ion concentration.

In 0.10 M acid the rates of acid dissociation of the Schiff base complexes derived from straight chain aliphatic primary amines increase in the order

$$CH_3 < C_2H_5 < C_4H_9 < C_3H_7.$$

Kinetic evidence is presented demonstrating that the product of the reaction between pyridinal-α-dl-phenylethylimine and ferrous ion is actually a mixture of two geometrical isomers one of which dissociates rapidly in acid solution and the other slowly.

The dissociation rates of both $[Fe(PPI)_3]^{+2}$ and $[Fe(bipy)_3]^{+2}$ were acid-catalyzed and of an order less than unity. Both rates were markedly effected by the nature of the anion present. It was also observed that the rate of dissociation of $[Fe(PPI)_3]^{+2}$ decreased as the ionic strength increased.

Attempts to demonstrate the existence of protonated species in dilute acid solutions of the iron(II)-methine compounds by spectral studies, titrations and solubility measurements gave inconclusive results. It was possible, however, through spectral, kinetic and magnetic studies of the behavior of $[Fe(PPI)_3]^{+2}$, $[Fe(bipy)_3]^{+2}$ and $[Fe(phen)_3]^{+2}$

in concentrated solutions of strong acids, to demonstrate conclusively the existence of protonated species in such solutions.

On the basis of the definite existence of protonated species in strong acid solutions and the possible existence of protonated species in dilute acid solutions, a reaction mechanism describing the mode of dissociation of $[Fe(PPI)_3]^{+2}$ and $[Fe(bipy)_3]^{+2}$ in acid solution was developed. The rate law derived from the proposed mechanism quantitatively describes the kinetics of acid dissociation of these ions.

The temperature dependence of the rate of dissociation of $[Fe(PPI)_3]^{+2}$ was studied over the temperature range 17.4°C to 30.5°C in dilute acid solution and 17.4°C to 36.2°C in 10 M $HClO_4$. The activation energy was 28.5 kcal. in both the concentrated and dilute acids.

The results of a spectral study of some iron(III)-methine type compounds in water and in concentrated acid solution are presented.

It was found that the rates of dissociation of the iron (II)-methine compounds in which the ligand was derived from pyridine-2-aldehyde and a primary aromatic amine were too rapid for convenient measurement even in dilute acid solution. Microfilm $2.50; Xerox $8.80. 191 pages.

‡The following abbreviations are used: PPI= pyridinal-n-propylimine, PRI = pyridinal-n-alkylimine, PAQ = 8-(α-pyridylmethyleneamino) quinoline, GBzI = glyoxal-bis-(benzylimine), bipy = 2,2'bipyridine and phen = 1,10 phenanthroline.

KINETICS, STEREOCHEMISTRY, AND MECHANISM OF THE CHLORIDE ION EXCHANGE WITH CIS-DICHLORO-BIS-ETHYLENEDIAMINE-PLATINUM(IV) ION

(L. C. Card No. Mic 58-5438)

Gordon Lee Johnson, Ph.D.
University of Illinois, 1958

The exchange of chloride ion with cis-dichloro-bis-ethylenediamine-platinum(IV) ion was studied and found to be first order in concentration of chloride ion, of cis-dichloro-bis-ethylenediamine-platinum(IV) ion, and of the catalyst, bis-ethylenediamine-platinum(II) ion. The experimentally measured heat of activation and the entropy of activation are 8.01 kcal. $mole^{-1}$ and -23.76 cal. $deg.^{-1}$ $mole^{-1}$, respectively. The specific rate constant at 30°C is 6.014×10^1 $liter^2$ $mole^{-2}$ $sec.^{-1}$.

The exchange rate is not appreciable at low concentrations of chloride ion except in the presence of a catalyst such as the bis-ethylenediamine-platinum(II) ion or the tetrammine-platinum(II) ion.

From infrared and X-ray studies, there is no indication of cis to trans conversion; and from optical rotation measurements on the 1-cis-dichloro-bis-ethylenediamine-platinum(IV) ion, there is no loss of optical activity under the conditions of the exchange study. Also, aquation of cis-dichloro-bis-ethylenediamine-platinum(IV) ion is negligible under these conditions. Therefore, the exchange appears to take place with retention of configuration and without the complication of aquation.

The exchange reaction is pictured as taking place between the chloride ion and an activated binuclear complex by means of a simple bimolecular transfer of chloride ions. The binuclear complex consists of the cis-dichloro-bis-ethylenediamine-platinum(IV) ion attached to the planar catalyst molecule by a chlorine atom from the platinum(IV) system. Microfilm $2.00; Xerox $4.40. 83 pages.

THE MERCURY PHOTOSENSITIZED HOMOMOLECULAR EXCHANGE OF OXYGEN

(L. C. Card No. Mic 58-3184)

Christopher John O'Shea, Ph.D.
Purdue University, 1958

Major Professor: William H. Johnston

Using oxygen-18 and a mass spectrometer an exchange reaction between pairs of oxygen molecules was discovered earlier by these workers. Subsequently, it was found that this exchange could be induced by mercury photosensitization using the mercury 2537 A resonance line. No dark reaction could be detected. The exchange reaction obeys the first order exchange law and involves a chain mechanism. A chain length of approximately twenty-five pairs of oxygen molecules exchanged per photon was measured. It was found that the apparent rate constant, defined as pairs of oxygen molecules exchanged per sec, varies directly as the intensity of the incident radiation. The slope of the plot of this relationship suggests a square root function, indicating that the chain terminating step is bimolecular, such as oxygen atoms recombining on the walls of the reaction vessel. Addition of an inert gas, spectroscopically pure nitrogen, resulted in an increase in the chain length as would be predicted for the behavior of inert third bodies. At higher pressures of nitrogen, the slope of the plot of the chain length versus pressure of nitrogen becomes zero and then negative, suggestive of the well-known Langmuir-Henschelwood kinetics where the mechanism of the reaction passes through the heterogeneous phase to the homogeneous phase at higher concentrations or pressures. The effect of increasing oxygen pressure at a fixed nitrogen pressure yields similar results, and mass spectrometric data suggests the formation of nitrogen oxides which further serve to introduce complexity into the reaction system. Changing the volume and surface area of the quartz reaction vessel indicated that the apparent rate constant is independent of volume, but dependent upon the surface area to the extent that the chain terminating steps probably occur on the walls. A mechanism involving oxygen atoms as the chain propagating specie, formed initially by collision with an excited mercury atom in the $6\ ^3P_1$ energy state is proposed. Formation and decomposition of ozone or an ozone-like complex is proposed as the mechanism of the exchange itself. Chain terminating steps involving deactivation and recombination on the walls or on other third bodies and/or the formation of nitrogen oxides are suggested to explain the overall reaction system.

Microfilm $2.00; Xerox $4.20. 77 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 × 8-1/2 inches; 4 cents per page. No postage is charged if check or money order accompanies order.

CHEMISTRY, ORGANIC

THE REACTION OF HYDRAZINE WITH 2-ACYL-1,3-INDANDIONES AND RELATED TOPICS

(L. C. Card No. Mic 58-5283)

Robert A. Braun, Ph.D.
University of Delaware, 1958

The monohydrazones of 2-acetyl-, 2-propionyl- and 2-phenylacetyl-1,3-indandione have been prepared and the hydrazone group has been shown to be on the side chain. 2-Diphenylacetyl-1,3-indandione, 1-hydrazone was prepared by the reaction of 2-diphenylacetyl-1,3-indandione with excess hydrazine in aqueous methanol. A series of mixed azines from these hydrazones and acetophenone was prepared.

2-Diphenylacetyl-1,3-indandione, 1-hydrazone has been found to be a potentially valuable reagent for identifying and characterizing carbonyl compounds, and is superior in several instances to the common carbonyl reagents. 2-Diphenylacetyl-1,3-indandione, 1-hydrazone is shown to react with aldehydes and ketones in the presence of acid catalyst to give mixed azines. Over fifty derivatives of carbonyl compounds containing a great variety of functional groups have been prepared. All the derivatives are fluorescent in ultra-violet light and represent a new class of fluorescent compounds.

The Wolff-Kishner reduction of 2-acyl-1,3-indandiones has been studied in detail and the products in all cases are 1,4-dihydro-3-substituted-indeno(1,2-c) pyrazoles. Three reaction intermediates have been isolated and characterized and all of the intermediates give 1,4-dihydro-3-substituted-indeno(1,2-c)pyrazoles upon further reaction under Wolff-Kishner conditions. A mechanism for the Wolff-Kishner reduction of 2-acyl-1,3-indandiones has been proposed.

The reaction of active halogen compounds with 3-substituted-(1,2-c)pyrazol-4(1H)-ones gives a new class of strongly fluorescent compounds. The products have been proven to be the result of N-alkylation only.

Microfilm $2.00; Xerox $5.20. 104 pages.

DERIVATIVES OF PIPERAZINE. XIX. THIOETHER DERIVATIVES OF PIPERAZINE AND SUBSTITUTED PIPERAZINES.

(L. C. Card No. Mic 58-3482)

Donald E. Butler, Ph.D.
The University of Florida, 1958

The problem was to produce a series of alkylthiomethylpiperazines and to show conclusively the general structure of a series of compounds resulting from the reaction of arylthiols, formaldehyde, and piperazines. These compounds could either be arylthiomethylpiperazines analogous to the products resulting when an alkylthiol is used in this reaction or ring substituted arylthiols. All of the compounds produced in this work were to be submitted to Parke, Davis and Company for pharmacological testing.

The series of alkylthiomethylpiperazines was prepared by mixing the appropriate piperazine and alkylthiol, followed by the addition of the correct amount of formalin. The mixture was refluxed, extracted with ether, and dried over anhydrous potassium carbonate. The product was purified by distillation or recrystallization.

The reaction of the arylthiols, formaldehyde, and the piperazines was carried out in the same manner as with the alkylthiols. The general structure of these products was studied by infra-red, ultraviolet, and mass spectra. Oxidation and reduction reactions of these compounds were also studied.

The products of the reaction of arylthiols, formaldehyde, and piperazines were shown to be arylthiomethylpiperazines rather than ring substituted thiophenols. A total of 48 new alkyl- and arylthiomethylpiperazines were produced and submitted to Parke, Davis and Company for pharmacological testing.

Microfilm $2.00; Xerox $5.60. 115 pages.

CERTAIN ASPECTS OF THE FRIEDEL-CRAFTS REACTION

(L. C. Card No. Mic 58-3904)

Bruce N. Campbell, Jr., Ph.D.
The University of Connecticut, 1958

This investigation is concerned with two aspects of the Friedel-Crafts reaction. The first (Part I) is a study of the preparation and use of AlI_3 as a Friedel-Crafts catalyst. The second (Part II) is a study of the isomeric compositions of the products resulting from the Friedel-Crafts isopropylation of acetophenone, methyl benzoate, and benzoic acid.

Part I

Three methods were developed for the preparation of AlI_3 as a Friedel-Crafts catalyst. Comparison is made of the results obtained with $AlCl_3$, $AlBr_3$, and AlI_3 for the isopropylation, succinoylation, and benzoylation of benzene. Although AlI_3 can be used for these three actions, only in the case of isopropylation does its use appear to have a possible advantage. In this case AlI_3 gives about as much or more monoisopropylbenzene than $AlCl_3$ or $AlBr_3$, and more diisopropylbenzene.

Part II

The first step in the study of the isopropylation of acetophenone, methyl benzoate, and benzoic acid was the preparation of the three isomeric isopropylacetophenones and the three isomeric methyl isopropylbenzoates by unequivocal syntheses. The infrared spectra of these isomers, acetophenone, and methyl benzoate were used to determine the composition of the isopropylation reaction products. The products of the isopropylations of benzoic acid were converted to the methyl esters for analysis.

Acetophenone was successfully alkylated with several catalysts: $AlCl_3$ (with and without solvent), $AlBr_3$, $FeCl_3$, and HF (without solvent). Carbon disulfide was the solvent when one was used, and either isopropyl chloride or diisopropyl ether was the alkylating agent. The yields of monoisopropylated product varied from about 1% to 23%. The

best yield was obtained with $AlCl_3$. The conversion taking into account acetophenone recovered varied from 4% to 41%. In all but three cases, m-isopropylacetophenone constituted essentially 100% of the monoisopropylated product. When $FeCl_3$ was used, it made up 96.5% of the product. With HF, m-isopropylacetophenone was 95% of the product, and with $AlCl_3$, diisopropyl ether, and no solvent, 83%.

Methyl benzoate was successfully isopropylated with isopropyl chloride, carbon disulfide, and $AlCl_3$, $AlBr_3$, or $FeCl_3$ or with diisopropyl ether and HF. The yield of monoalkylated product varied from 2% to 23%. The best yield was obtained with HF and diisopropyl ether. The conversion varied from 8% to 36%. Only two cases were found where methyl m-isopropylbenzoate constituted less than 97% of the monoisopropylated product. The percentage of the meta isomer was 91% with $FeCl_3$ and 89% with HF.

The isopropylation of benzoic acid was carried out successfully with $AlCl_3$ or $AlBr_3$, carbon disulfide, and isopropyl chloride or with HF and diisopropyl ether. The yield of monoisopropylated product varied from 0% to 13%. The latter yield was obtained with diisopropyl ether and HF. The conversion varied from 0% to 20%. Only when HF was used was the percentage of the meta isomer in the monoisopropylated product less than 97%. In that case it was 94.5%.

Although with these three systems little of the para or ortho isomers was found, the para isomers appear to be formed more readily than the ortho.

The usual directive influences of these negative substituents (acetyl, carboxyl, and carboxymethyl) as determined by nitration[1] would not account for such preponderance of the meta isomers. Attempted isomerization of the ortho and para isomers to the meta isomers with conditions similar to those used for alkylation was unsuccessful.

It is proposed that Friedel-Crafts catalysts complex with these three negative substituents, probably with the carbonyl oxygen, to give "substituent groups" which have a much greater meta directing influence.

Microfilm $2.00; Xerox $6.00. 125 pages.

1. Ferguson, Chem. Revs., 50, 48 (1952).

A QUANTITATIVE STUDY ON THE MERCURATION OF AROMATICS

(L. C. Card No. Mic 58-3150)

Michael Dubeck, Ph.D.
Purdue University, 1958

Major Professor: Herbert C. Brown

The rate of mercuration of tertiary butylbenzene with mercuric acetate in glacial acetic acid at 90.0° is 8.40×10^{-5}; at 70.0° 1.52×10^{-5} and 50°, 0.245×10^{-5} liter $mole^{-1}$ $sec.^{-1}$. Substitution occurs predominantly in the meta and para positions, ortho substitution occurs to less than 1%. At 90.0°, the distribution is 34.9% meta, 65.1% para; at 70.0°, 32.9% meta, 67.1% para; at 50.0°, 31.0% meta and 69.0% para. The results indicate that substitution meta to a t-butyl group occurs more readily than substitution meta to a methyl group. However, substitution proceeds more readily para to a methyl group than para to a t-butyl group.

The rate and isomer distribution in the mercuration of biphenyl with mercuric acetate in glacial acetic acid has been determined at 90, 70, and 50°C. The isomer distribution at 90° is 69.0% para, 23.4% meta and 7.6% ortho; at 70°, 72.4% para, 22.6% meta and 5% ortho; at 50° the distribution is 75.1% para 21.1% meta and 3.8% ortho. The results indicate that the para position is activated and the meta and ortho positions are deactivated in the mercuration of biphenyl.

The rate and isomer distribution have been measured for the mercuration of anisole with mercuric acetate in glacial acetic acid at 25.0°C. The isomer distribution is 14.0% ortho and 86.0% para. The presence of meta substitution could not be detected. The partial rate factor for the ortho position is 188 and for the para position 2312. The meta partial rate factor was estimated from the rate of mercuration of para dimethoxybenzene to be 1.2. Rates of mercuration of the following substituted anisoles have been measured para methylanisole, para phenylanisole, and para tertiary butylanisole. The mercuration partial rate factors for methyl, t-butyl, phenyl and methoxy have been correlated with the accepted "sigma plus" constants for these substituents.

A kinetic study of the perchloric acid catalyzed mercuration of benzene with mercuric acetate at 25.0°C. has been carried out in a medium of acetic acid that was approximately anhydrous. The variation of the observed second order rate constant with perchloric acid and mercuric acetate concentration tends to indicate the presence of a reaction between these two components which liberates the attacking electrophilic species. Evidence is compiled which suggests that the attacking electrophilic species is a monoprotonated form of mercuric acetate.

Microfilm $2.00; Xerox $7.00. 149 pages.

STERIC EFFECTS OF GEM-DIMETHYL SUBSTITUTION

(L. C. Card No. Mic 58-5285)

John A. Ford, Jr., Ph.D.
University of Delaware, 1958

The introduction of a gem-dimethyl group into cis-vic-cyclopentanediol at C_4 had no effect upon the ring conformation. When it occurred at C_5, the extent of ring pucker increased to relieve the eclipsed conformation between the hydroxyl on C_1 and the methyl groups on C_5. This effect decreased the interhydroxyl distances as shown by a tightening of the internal hydrogen bond and an increase in the stability of the boric acid complex. Although cis-1,2-cyclopentanediol and 4,4-dimethyl-cis-1,2-cyclopentanediol had equal hydrogen bond distances, the stabilities of the boric acid complexes were not equal due to steric inhibition of complex formation by the methyl groups in the case of the latter compound.

cis-1,3-Cyclohexanediol underwent a change in the conformation of the hydroxyls from diaxial to diequatorial when a gem-dimethyl group was introduced at C_5. The stability derived from internal hydrogen bond formation which was responsible for the hydroxyls occurring in the normally unfavorable diaxial conformation in the unmethylated compound was not available to the dimethyl compound

whose methyl groups impeded the formation of an internal hydrogen bond.

A convenient method was worked out for the reduction of dimedon and the isolation of 5,5-dimethyl-cis-1,3-cyclohexanediol. It was found that this compound gave a cuprammonium complex, an indication that cuprammonium solution created its own favorable geometry for complex formation.

Acyloin condensation of cis-1,3-dicarbomethoxycyclopentane gave the endo-hydroxy acyloin whereas similar treatment of dimethyl camphorate gave a mixture of exo- and endo-hydroxy acyloins showing that substitution of the methyl groups destroyed the stereospecificity of the acyloin condensation in forming bicyclic acyloins. A tentative mechanism in accord with the above observations was proposed. Microfilm $2.00; Xerox $3.60. 64 pages.

PREPARATION AND AROMATIZATION OF POLY-1,3-CYCLOHEXADIENE

(L. C. Card No. Mic 58-5428)

Gordon Ellsworth Hartzell, Ph.D.
University of Illinois, 1958

The lower members of the p-polyphenyl series melt at relatively high temperatures without decomposition. It would therefore be predicted that high molecular weight p-polyphenyls should possess high thermal stability. Attempted synthesis of such p-polyphenyls involved 1-4 polymerization of 1,3-cyclohexadiene to a linear polymer containing cyclohexene recurring units, which might then be dehydrogenated to a p-polyphenyl.

Four preparations of 1,3-cyclohexadiene were used: (1) dehydrobromination of 1,2-dibromocyclohexane with quinoline, (2) dehydrobromination of 1,2-dibromocyclohexane with sodium ethoxide, (3) pyrolysis of 1,2-diacetoxycyclohexane and (4) dehydrobromination of 3-bromocyclohexene with quinoline. The last named method was found to be the most convenient and gave the monomer in the highest purity.

Polymerization of 1,3-cyclohexadiene was accomplished in conversions as high as ninety-six per cent, using a Ziegler catalyst composed of a mixture of triisobutylaluminum and titanium tetrachloride. This monomer represents the first non-terminal conjugated diolefin to be polymerized with a Ziegler type catalyst. Optimum conditions for the polymerization included the use of 0.5 to 4.0 per cent of triisobutylaluminum and sufficient titanium tetrachloride to obtain a molar ratio of the aluminum alkyl to the titanium compound of 0.9:1 to 5.1:1. Best results were obtained at temperatures of 25° or lower and using n-heptane or cyclohexane as the solvent. The polymers obtained were low molecular weight, amorphous powders, possessing inherent viscosities in the range of 0.10 to 0.16. These values correspond very roughly to a molecular weight of perhaps five thousand to ten thousand. Poly-1,3-cyclohexadiene is a white, somewhat waxy powder, which appears to soften at about 170-180°. The polymer is slowly oxidized by air at room temperature and is quite rapidly oxidized at elevated temperatures. Poly-1,3-cyclohexadiene is from seventy-five to one hundred per cent soluble in benzene, toluene and carbon disulfide, but is insoluble in ether, acetone and methanol. A brittle transparent film is formed upon slow evaporation of a solution of the polymer.

At least partial dehydrogenation of poly-1,3-cyclohexadiene was accomplished using palladium, chloranil, N-bromosuccinimide and sulfur. The products obtained from the use of these reagents all possessed nearly identical infrared spectra, which were indicative of the presence of p-polyphenyls. The most intense absorption maximum in all the spectra was that occurring at 811 $cm.^{-1}$, corresponding to 1-4 aromatic substitution. Best results were achieved using chloranil, with which an insoluble, tan-brown powder was obtained, the infrared spectrum of which showed the presence of polyphenyl. Analyses and infrared spectra of this material also showed the presence of dihydrochloranil and unaromatized poly-1,3-cyclohexadiene. Although the unaromatized polymer and the dihydrochloranil could be destroyed by heating the tan-brown material at 450° under nitrogen, this treatment also caused carbonization to occur. A black powder was obtained which was shown by analysis to be composed of about ninety per cent polyphenyl and ten per cent carbon. This black mixture did not melt when heated to 530°. Although the material was very stable under a nitrogen atmosphere, it was slowly destroyed by heating in air at temperatures above 300°. This instability of the polymer at high temperatures may be attributed to oxidation of unaromatized sections of the polymer. X-ray powder patterns of the p-polyphenyl, which were identical to those obtained from p-quaterphenyl with respect to the positions and the relative intensities of the major rings, showed the polymer to be highly crystalline. The d-spacing of 4.54 Å, corresponding to the most intense ring in the transmission pattern of p-polyphenyl, is very nearly equal to the length of one phenyl recurring unit. Although a pure p-polyphenyl could not be isolated because of its insolubility, infrared spectra, analyses and x-ray diffraction studies confirmed the existence of a p-polyphenyl obtained by dehydrogenation of poly-1,3-cyclohexadiene. Microfilm $2.00; Xerox $5.00. 97 pages.

I. DERIVATIVES OF P-PHENYLPHOSPHONAMIDIC AND THIOPHOSPHONAMIDIC ACIDS
II. RESOLUTION STUDIES OF DERIVATIVES OF P-PHENYLPHOSPHONAMIDIC ACIDS

(L. C. Card No. Mic 58-5431)

Marion Frank Hersman, Ph.D.
University of Illinois, 1958

PART I

Benzene phosphonochloridate has been allowed to react partially with alcohols and phenols, then subsequently with amines and ammonia to give a series of alkyl (aryl) P-phenylphosphonamidates. The first step of the reaction comprises reacting an alcohol or phenol with benzene phosphonochloridate to produce the corresponding half ester chloridate. The aryl derivatives were isolated in the pure form. However the alkyl phosphonochloridates decompose to form the alkyl chlorides and a residue of the polymeric metaphosphonate.

The half-ester chloridates, $C_6H_5PO(OR)Cl$, will react with ammonia, and with primary or secondary amines to

give the alkyl (aryl) P-phenylphosphonamidates, alkyl (aryl)-N-alkyl (aryl)-P-phenylphosphonamidates, and alkyl (aryl)-N-dialkyl-P-phenylphosphonamidates, respectively. The corresponding thio derivatives were obtained from the benzene thiophosphonochloridates.

These products exhibit hydrogen bonding characteristics. They are unstable in both acid and alkali in aqueous solutions. The P-O linkage is cleaved in alkaline solution, whereas the P-N bond is cleaved easily in an acid medium. On continued heating in an acid medium both the P-O and P-N bonds are cleaved to give the phosphonic acid.

When solutions of alkyl P-phenylphosphonochloridates are heated to remove the solvent decomposition occurs to give the alkyl chlorides and benzene metaphosphonate $(C_6H_5PO_2)_x$. The metaphosphonate undergoes initial hydrolysis to diphenyl pyrophosphonic acid, but ultimately on continued hydrolysis yields benzene phosphonic acid.

PART II

The resolution of some phosphonamidates by several methods has been attempted. The formation of internal diasterioisomers was not accomplished by the reaction of pseudoephedrine with phenyl P-phenylphosphonochloridate due to hydrolysis of the P-N linkage and consequent formation of the amine salt of the corresponding acid. Such acids no longer possess a center of asymmetry due to the equivalence of the two P-O bonds and are therefore not capable of being resolved into their optical antipodes. Attempts to prepare diasterioisomers through salt formation with the reaction product of phenyl P-phenylphosphonohydrazidate and pyruvic acid were unsuccessful since no crystalline derivatives could be prepared.

Attempts to resolve several simple phosphonamidates by adsorption on optically active quartz or lactose hydrate were equally unproductive. The reactions with such adsorbents were carried out both by means of shaking reactions for various time intervals, and chromatographically, but neither method gave positive results. It is well known, however, that resolutions by means of optically active adsorbents have not been uniformly fruitful; there is no basis for predicting whether any given resolution can be accomplished. Only partial resolutions have been achieved heretofore by this method when it has proved of utility.

The ability to resolve compounds of this type is not in doubt, however, due to the recent work of Vander Werf.

Microfilm $2.05; Xerox $7.20. 154 pages.

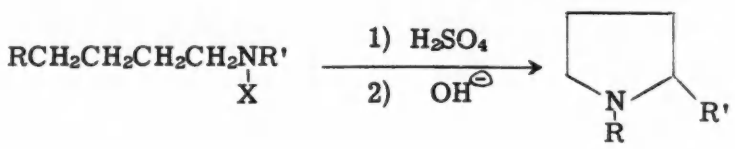
FORMATION OF δ-HALOAMINES AND CYCLIC AMINES BY THE FREE RADICAL CHAIN DECOMPOSITION OF N-HALOAMMONIUM IONS PART I. MECHANISM AND SCOPE PART II. SYNTHESIS OF DIHYDROCONESSINE

(L. C. Card No. Mic 58-5433)

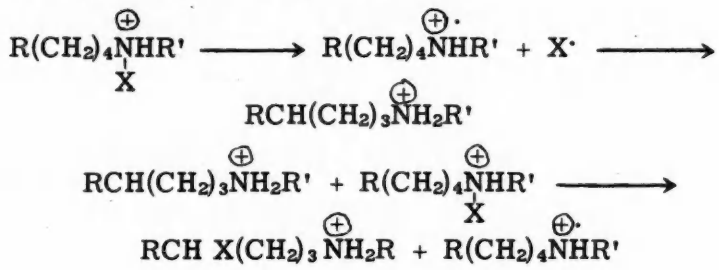
Walter Raymond Hertler, Ph.D.
University of Illinois, 1958

Part I. Mechanism and Scope

It has been shown that the decomposition of N-haloamines in acid solution according to the equation,



proceeds by a free radical chain mechanism. Initiation by ferrous ion and catalysis by acid have been demonstrated. The immediate product of the decomposition of the N-haloamine was shown to be a δ-haloamine which is formed according to the following equations:



It has been shown that the decomposition of (-) methylamylchloroamine-4-d in acid proceeds with racemization at the asymmetric carbon atom, and a substantial hydrogen isotope effect is observed in this decomposition. The rate of decomposition of N-haloamines was shown to be sensitive to steric factors.

Part II. Synthesis of Dihydroconessine

A method has been developed for the direct introduction of a functional group to C_{18} of steroids. The method is illustrated by the formation of the Holarrhena alkaloid derivative, dihydroconessine, from the decomposition of N-chloro-3β-dimethylamino-20α-methylaminoallopregnane in acid solution. Incidental to the synthesis of dihydroconessine, it was found that treatment of a formamide with p-toluene sulfonyl chloride and pyridine resulted in dehydration of the formamide to an isonitrile. The transformation was studied in the aromatic, alicyclic, and aliphatic series. Microfilm $2.00; Xerox $5.20. 102 pages.

STUDIES RELATING TO THE Sn2' REACTIVITY OF t-BUTYL VINYL CARBINYL STRUCTURE

(L. C. Card No. Mic 58-5290)

Frank J. Kushibab, Ph.D.
University of Delaware, 1958

Adviser: H. Kwart

Allylic molecules of the type, $R\text{-}\underset{X}{CH}\text{-}CH = CH_2$, undergo bimolecular nucleophilic displacements by either an Sn2 or an Sn2' mechanism, the former leading to the normal displacement product and the latter resulting in the formation of rearranged product. In view of this the reactions of t-butyl vinyl carbinyl derivatives with nucleophilic reagents were of interest. It would appear that the bulkiness of the α-t-butyl group might prohibit the normal Sn2 attack, and hence an Sn2' displacement might be realized. An investigation of this involved the synthesis of t-butyl vinyl carbinol, the conversion of it to suitable derivatives, and the study of the reactions of these derivatives with

nucleophilic agents. In addition, the preparation of the corresponding isomeric alcohol, 4,4-dimethylpentene-2-ol-1 was required since it would serve as a starting point for the preparation of the Sn2' product of the reactions with the t-butyl vinyl carbinyl compounds, the independent synthesis of which would serve as a structure proof.

A synthesis of t-butyl vinyl carbinol is not reported in the literature. However, by using an article published in 1936 by a French chemist, J. Colonge, as a basis for a synthesis, a preparation of t-butyl vinyl carbinol was accomplished. A reaction of pinacolone, formaldehyde and gaseous HCl in the presence of zinc chloride produced t-butyl β-chloroethyl ketone. Heating this with triethylamine in benzene effected a dehydrohalogenation and the t-butyl vinyl ketone thus produced was then reduced with aluminum isopropoxide.

The alcohol isomeric to t-butyl vinyl carbinol, 4,4-dimethylpentene-2-ol-1, also not reported in the literature, was synthesized, though in poor yield. The condensation of trimethylacetaldehyde with diethyl malonate produced trimethylethylidene malonic ester. Saponification and decarboxylation of this resulted in the formation of 4,4-dimethyl-2-pentenoic acid. The reaction between this acid and lithium aluminum hydride produced small amounts of the corresponding alcohol. Polymerization of the acid was the predominant reaction.

It was anticipated that concerted displacement reactions with derivatives of t-butyl vinyl carbinol would proceed through an Sn2' mechanism, but attempts to demonstrate bimolecular displacements by reacting various nucleophilic reagents with derivatives led to the following results: The p-nitrobenzoate ester derivative proved to be completely inert in reactions with triethylamine, pyridine, and piperidine. A reaction between this derivative and thiophenolate anion failed because of an oxidation-reduction reaction that occurred between the anion and the nitro group of the ester. The reaction between the methanesulfonate ester derivative and piperidine yielded products which indicated that decomposition of the ester was the prevailing reaction, rather than a nucleophilic displacement.

Microfilm $2.00; Xerox $5.00. 99 pages.

I. POLYMERIC BASIC BERYLLIUM CARBOXYLATES
II. POLYMERIC PHTHALOCYANINES

(L. C. Card No. Mic 58-5451)

Michael McCulloch Martin, Ph.D.
University of Illinois, 1958

I. Low molecular weight polymeric basic beryllium carboxylates were prepared by the condensation of equimolar quantities of a basic beryllium salt, $Be_4O(RCO_2)_6$, such as the acetate, propionate, or benzoate, with a dibasic acid chloride, such as adipyl, sebacyl, beta-ethyladipyl, terephthalyl, or isophthalyl chloride, in a hydrocarbon solvent, such as benzene, toluene, or xylene. The materials were white powders when completely free of solvent, with viscosities ranging from 0.01 to 0.06. When plasticized with a little solvent, they could be drawn into short fibers, and adhered to glass. The linear polymers disproportionated into crosslinked polymers and the corresponding monomeric basic beryllium carboxylates at rates dependent upon their structure. Those polymers containing all aliphatic acid groups disproportionated within a few days at room temperature, while those containing aliphatic and aromatic acid units disproportionated slowly at room temperature and rapidly at 350°C. This appeared to be the only mode of decomposition at this temperature. Polymers were also prepared by the benzoyl peroxide-initiated vinyl polymerization of two acrylate-containing basic beryllium carboxylates. Insoluble polymers were produced from basic beryllium acrylate and a slightly impure sample of basic beryllium pentapropionate monoacrylate. The former compound should give a crosslinked and consequently insoluble polymer, but the latter should give a soluble, linear polymer. It is believed that insolubility is due to crosslinking arising from the presence of basic beryllium salts containing more than one acrylate group. These products were white powders which underwent extensive decomposition with carbonization at 200°C.

II. The cocondensation of phthalonitrile and 3,3',4,4'-tetracyanodiphenyl ether under phthalocyanine-forming conditions was studied, and found to give rise to dimeric or trimeric products. No high molecular weight polymeric phthalocyanines were formed. The cocondensation was studied in the presence of copper-bronze and sodium amylate, and both reactions led to products with a low degree of polymerization. The products were characterized by infrared and visible spectra, which demonstrated that they were phthalocyanines, and by viscosity and analytical data, which were consistent with a low degree of polymerization. These products underwent extensive oxidative degradation in air at 350°C.

The 3,3',4,4'-tetracyanodiphenyl ether was prepared by dehydration of the corresponding tetraamide with thionyl chloride in dimethylformamide at 60°C. The tetraamide was prepared from the reaction of excess concentrated ammonia with the diimide which was the product of the pyrolysis at 250-280°C. of the tetraamonium salt of 3,3', 4,4'-tetracarboxydiphenyl ether. This tetrabasic acid was prepared by the permanganate oxidation of 3,3',4,4'-tetramethyldiphenyl ether, which was synthesized from the reaction of 4-bromo-o-xylene and 3,4-dimethylphenol in the presence of potassium hydroxide and copper.

Microfilm $2.00; Xerox $5.00. 96 pages.

THE OXIDATION OF SECONDARY ALCOHOLS WITH CHROMIC ACID, NITROGEN DIOXIDE AND TERT.-BUTYL HYPOCHLORITE

(L. C. Card No. Mic 58-5293)

Francis Richard McGranaghan, Ph.D.
University of Delaware, 1958

The oxidation of t-butylphenyl carbinol, t-butylanisyl carbinol and t-butyl-p-tolyl carbinol with chromic acid has been studied. The extent to which these alcohols undergo oxidative cleavage to benzaldehyde derivatives and t-butyl alcohol was found to be a function of the para substituent; the maximum cleavage being obtained with the t-butylanisyl carbinol and the smallest amount of cleavage with the t-butylphenyl carbinol. It was found that very low

chromic acid concentrations increased the amount of cleavage products formed at the expense of the normal oxidation to the ketonic products. Cleavage yields of greater than eighty percent were obtained from both the oxidation of t-butylanisyl carbinol and t-butyl-p-tolyl carbinol. The mechanistic implications of these results are discussed.

Benzopinacolyl alcohol has been oxidized with nitrogen dioxide and nitrogen tetroxide in chloroform and nitrobenzene. Oxidation at 100°C in chloroform produced triphenyl carbinol, benzoic acid and benzopinacolone. Oxidation in nitrobenzene resulted in dehydration followed by nitration to yield tetra-kis-p-nitrophenylethylene.

The oxidation of t-butylphenyl carbinol with nitrogen dioxide gave small amounts of cleavage products. The predominant reaction was esterification of the alcohol to the nitrite ester.

Benzopinacolyl alcohol was oxidized with t-butyl hypochlorite in carbon tetrachloride to yield triphenyl carbinol, benzaldehyde and benzopinacolone. Oxidation of t-butylphenyl carbinol with the same reagent gave a small amount of benzaldehyde along with the normal oxidation product, t-butylphenyl ketone.

The chlorination of toluene in acetic acid and in carbon tetrachloride was investigated using t-butyl hypochlorite as the chlorinating agent. In glacial acetic acid the exclusive reaction was nuclear chlorination while in carbon tetrachloride side chain chlorination is the only reaction observed. Microfilm $2.00; Xerox $3.00. 59 pages.

THE ACETYLATION OF 1,1'-DIMETHYLFERROCENE

(L. C. Card No. Mic 58-5465)

Kaye Lamarr Motz, Ph.D.
University of Illinois, 1958

1,1'-Dimethylferrocene has been acetylated under Friedel-Crafts conditions to give 2-acetyl-1,1'-dimethylferrocene and 3-acetyl-1,1'-dimethylferrocene in the relative proportion of 30% to 70%. These compounds have been reduced to the corresponding 2-ethyl-1,1'-dimethylferrocene and 3-ethyl-1,1'-dimethylferrocene. They have been oxidized to the corresponding 1,1'-dimethylferrocene-2- and 3-carboxylic acids.

Electronic and steric effects have been examined for these substituted ferrocenes and compared to the correspondingly substituted benzenes. Influence of these effects on the acetylation reaction of the dialkyl derivatives, on the ultraviolet spectra of the ketones and on the dissociation constants of the acids has been discussed.

The formation of nearly equal amounts of 2- and 3-acetyl-1,1'-dimethylferrocene on acetylation of 1,1'-dimethylferrocene illustrates the difference in steric requirements of the ferrocene and benzene systems since the para isomer is formed nearly exclusively on acetylation of toluene.

Maximum absorption of the most intense band occurs at longer wave length in the ultraviolet spectra of both 2-acetyl- and 3-acetyl-1,1'-dimethylferrocenes than in the spectrum of acetylferrocene. The extinction coefficient of the 2-acetyl isomer is higher and that of the 3-acetyl isomer lower than that observed in acetylferrocene. This behavior is in sharp contrast to that of the benzene analogs, in which the ortho isomer shows a band of decreased intensity. The difference in behavior of the ortho isomers in the two systems has been attributed to differences in the steric requirements of the ferrocene and benzene systems.

A similar contrast has been found in the dissociation constants of the corresponding acids of the ferrocene and benzene series. The dissociation constants of 1,1'-dimethylferrocene-2- and 3-carboxylic acids are both lower than that of ferrocenecarboxylic acid. In contrast o-toluic acid has a dissociation constant higher, m- and p-toluic acids lower than that of benzoic acid. This difference is also attributed to a difference in the steric requirements of the two systems.

The infrared spectra of acetyldimethylferrocenes have been examined. Characteristic bands in the 1275-1300 $cm.^{-1}$ region have been found to differentiate the 2-acetyl from the 3-acetyl isomer. Shifts in the positions of these bands are similar to those of the corresponding o-, m- and p-methylacetophenones in this region. Characteristic bands for the two isomeric acetyldimethylferrocenes also have been found in the 900-1000 $cm.^{-1}$ region.

1,1'-Dimethylferrocene has been diacetylated under Friedel-Crafts conditions. cis-2,2'-Diacetyl-, trans-2,2'-diacetyl-, cis-3,3'-diacetyl- and trans-3,3'-diacetyl-1,1'-dimethylferrocenes have been obtained as crystalline solids from this acetylation. The cis-trans isomers are characterized by differences in melting points and by band splitting in the solid state infrared spectra. These compounds have been reduced to the corresponding diethyldimethylferrocenes. Evidence has also been presented for the isolation of cis- and trans-2,3'-diacetyl-1,1'-dimethylferrocenes.

A mixture of cis- and trans-2,2'-diethyl-1,1'-dimethylferrocenes has been independently synthesized from 1-ethyl-2-methylcyclopentadiene.

Examination of the infrared spectra of the acetyl- and diacetyldimethylferrocenes and of the ethyl- and diethyldimethylferrocenes has led to a proposed "Rule of spectral independence of ferrocene rings." This rule states that the infrared spectrum of a ferrocene in which each of the rings is substituted differently will be nearly a composite of the spectra of two ferrocenes one of which has both rings substituted as is one ring and the other which has both rings substituted as is the other ring of the ferrocene which has the two rings substituted differently.

From the number of isomers obtained by acetylation and diacetylation of 1,1'-dimethylferrocene further evidence has been obtained for free rotation of the cyclopentadienyl rings of ferrocenes.

Attempts have been made to prepare solid derivatives of ferrocenes employing 2,4,5,7-tetranitrofluorenone. Although evidence has been obtained for complex formation between tetranitrofluorenone and ferrocene or alkylsubstituted ferrocenes, the acetylferrocenes do not appear to form a complex.

Microfilm $2.00; Xerox $6.40. 135 pages.

THERMAL DEGRADATION OF CARBAMATES OF METHYLENEBIS (4-PHENYL ISOCYANATE)

(L. C. Card No. Mic 58-5295)

George Earl Newborn, Jr., Ph.D.
University of Delaware, 1958

Quantitative studies have been made of the thermal degradation at 300° of the biscarbamates prepared from methylenebis (4-phenyl isocyanate) and 1-butanol, neopentyl alcohol, and benzyl alcohol and of the polycarbamate from methylenebis (4-phenyl isocyanate) and 1,6-hexanediol.

All of the carbamates gave carbon dioxide and the parent alcohol or diol. In addition, the n-butyl biscarbamate, the benzyl carbamate, and the polycarbamate gave dehydration products of the alcohol, namely, 1-butene, benzaldehyde and toluene, and 1-hexene-6-ol, respectively.

The benzyl biscarbamate and the polycarbamate yielded amine residues from which p,p'-diaminodiphenylmethane was isolated. Polymeric carbodiimides were identified as degradation products of the n-butyl and neopentyl biscarbamates; it was shown in the case of the benzyl biscarbamate and the polycarbamate that the polymeric carbodiimides are possible intermediates for formation of amines and olefins. Microfilm $2.00; Xerox $4.60. 90 pages.

STUDIES IN THE BROMINATION AND OXIDATION OF NORBORNANE CARBOXYLIC ACIDS

(L. C. Card No. Mic 58-5296)

George D. Null, Ph.D.
University of Delaware, 1958

The alkaline permanganate oxidation of norbornane-2-endocarboxylic acid and norbornane-2-exocarboxylic acid yielded one product, 2-exohydroxy-2-endocarboxylic acid. Either a free radical or enolic intermediate may be postulated as a precursor to the hydroxy acid.

Bromination of the two acids, norbornane-2-endocarboxylic acid and norbornane-2-exocarboxylic acid, also led to a single product, in this case the 2-exobromonorbornane-2-endocarboxylic acid. By the same bromination procedure, camphenilanic acid and isocamphenilanic acid yielded the 2-endobromocamphenilanic acid. The formation of the single product from each pair of acids, with opposite configuration of the bromine in the two cases, is ascribed to the attack of bromine on an enolic intermediate from opposite sides.

Catalytic hydrogenolysis of 2-exobromonorbornane-2-endocarboxylic acid and 2-endobromocamphenilanic acid in alcoholic potassium hydroxide with palladium on charcoal produced a novel rearrangement to give respectively norbornane-1-carboxylic acid and apocamphane-1-carboxylic acid. The same rearrangement occurred when the corresponding methyl esters of 2-exobromonorbornane-2-endocarboxylic acid and 2-endobromocamphenilanic acid were treated with zinc in glacial acetic acid.

To further the understanding of the factors involved in ionic additions to bicyclic compounds, norcamphene and camphene were epoxidized to give respectively norcamphene oxide and camphene oxide. The lack of adherence to the rule of exo addition in the latter case may be attributed to asymmetry of electron distribution in the bicyclic double bond and the nature of the charge on the approaching fragment. Microfilm $2.00; Xerox $4.60. 86 pages.

THE CHEMISTRY OF A THERMALLY OXIDIZED OIL

(L. C. Card No. Mic 58-5475)

Edward George Perkins, Ph.D.
University of Illinois, 1958

Thermal oxidation of corn oil at 200°C. for forty-eight hours produced an oil which was of lowered nutritional value when compared with fresh corn oil.

Fractionation of the fatty acids obtained from the thermally oxidized corn oil by means of urea complex formation and molecular distillation at 1 to 3 microns pressure produced several fractions each having varying nutritional value, depending upon the percentage of polymeric material present in the fraction. The nutritional value of the fractions was proportional to the percentage of non urea adduct forming fatty acids present in the fractions and the molecular weight of the fractions. The material which was not distillable in a molecular still proved to be "toxic" when fed to male weanling rats at the 12 percent level, and caused the death of rats within a week. This material was shown to be present as 27.2 percent of the thermally oxidized oil. No specific biological effect could be found to account for the "toxicity" observed. The animals lost weight, had extreme diarrhea, enlarged livers, and then died, in some cases with intestinal hemorrhage.

The "toxic" fraction was concentrated by means of solvent extraction methods with the aid of Skellysolve F and cyclohexane. This treatment resulted in the isolation of several fractions having high oxygen content and high molecular weights, ranging from 500 to 1600. The isolated fractions seemed to be hydroxylated carboxylic acid type polymers. All of the oxygen not present as carboxyl groups was present as hydroxyl groups. Cleavage with periodic acid yielded five different carbonyl derivatives, which indicated the presence of the alpha-dihydroxy group in the polymer isolates. The infrared spectra of these fractions were identical with each other and with methyl linoleate, indicating that they probably had the same monomeric units. Attempts to determine the presence of cyclic systems in the isolated polymers indicated that there were no such systems present in thermally oxidized corn oil. A qualitative measurement of unsaturation in the polymer fractions indicated the presence of double bonds. The amount of unsaturation present in the isolated polymeric fraction was dependent upon the molecular weight of the polymer fraction. A mechanism which takes these observations into consideration and which could possibly account for the formation of these types of polymers is discussed.

The volatile oxidation products from the thermal oxidation of corn oil were collected and were shown to consist essentially of aldehydes and ketones. These products were converted to their corresponding 2,4-dinitrophenylhydrazones and separated by chromatography. From this mixture of compounds 2-heptanone, butanal, n-hexanal, n-heptanal, and 2-ethylbutyraldehyde were isolated and

identified. Several other 2,4-dinitrophenylhydrazones were isolated, but could not be identified.

Microfilm $2.00; Xerox $4.60. 89 pages.

STUDIES IN BICYCLIC BROMOKETONES

(L. C. Card No. Mic 58-5298)

Vincent A. Rolleri, Ph.D.
University of Delaware, 1958

The 1:1 adducts of chloroform and of bromotrichloromethane with norbornene, under free radical conditions, were prepared. The addition apparently occurred in the 1, 2 position since no evidence for rearrangement appeared. That the 1,2 addition occurred in a cis fashion seemed indicated from the dipole moment measurements of the resulting adducts. The measured moments were greater than would be calculated for the trans products. Thus, although the dipole moment data were not unambiguous, they indicated a probable course of cis addition. These results are in agreement with those reported by other workers, who have also concluded that no substantial evidence exists for the incidence of so-called "bridged" free radicals in bicyclic systems. If such intermediates did occur, the rearranged products undoubtedly would have been observed as is the experience of the abundant literature on ionic reaction mechanisms.

In an attempt to ascertain the structure of the adducts, the latter were dehydrochlorinated with potassium tert-butoxide and the resulting compounds oxidized to the corresponding ketones. The chloroform-norbornene adduct led to norcamphor, a clear chemical proof of simple, unrearranged, 1,2-addition. The adduct from bromotrichloromethane and norbornene, however, gave rise to a bromoketone of unknown structures. The infrared and ultraviolet spectral characteristics of this compound indicated that it was not a bromoketone of the norbornane family. This bromoketone had an unexpectedly high E_{max} in the ultraviolet, and its infrared spectrum showed the presence of a doublet at 1733 and 1754 cm^{-1}. It is probable that ring opening occurred, and that the product is a substituted bromocyclohexanone. That this compound was not a member of the norbornane or camphane bicyclic systems was shown by a comparison of its spectral characteristics with those of the ketones and bromoketones of these systems. Some new ketones and bromoketones were prepared in order that their spectral properties could be studied. For example, 5-exo-bromonorcamphor was prepared by the addition of HBr to endodehydronorcamphor. The spectral characteristics of this compound agree with the structure recently proposed for it by Cristol.

Among the compounds prepared were syn-2-bromo-7-norbornanone and its isomer, syn-7-bromo-2-norbornanone. These compounds showed marked differences in their infrared spectra. The unusual character of carbonyl absorption by 7-norbornanone in the infrared, as reported earlier by other workers, was confirmed. It was compared with the corresponding ketone having a double bond in the 2,3 position. The peculiar carbonyl doublet does not appear in this latter compound.

Microfilm $2.00; Xerox $4.40. 82 pages.

THE REACTION OF DECABORANE WITH SUBSTITUTED ALCOHOLS

(L. C. Card No. Mic 58-5300)

Wayne Curtis Schar, Ph.D.
University of Delaware, 1958

Decaborane reacts with alcohols to yield the corresponding trialkyl borates and hydrogen in quantitative yield. The availability of the electrons on the oxygen of the alcohol has been varied with the use of substituents having different electron affinities. A more rapid degradation to products is observed as the electron availability increases. The kinetic data indicate that the reaction proceeds through a complex, which decomposes by the elimination of a hydrogen atom from the alcohol. Deuterium substituted alcohols show a decrease in reactivity, strengthening this observation.

Several orthoborates were prepared to prove the synthetic utility of the reaction. In all cases with the aliphatic monofunctional alcohols, the reaction proceeded without complications. Difunctional alcohols form polymeric borates, whereas the very hindered aromatic substituted or cycloparaffinic alcohols essentially did not react at all. No intermediates were found in alcoholic solutions.

Microfilm $2.00; Xerox $4.40. 82 pages.

STUDIES IN THE SESQUITERPENE FIELD: THE SYNTHESIS OF α-SANTALENE AND AN APPROACH TO THE SYNTHESIS OF LONGIFOLENE

(L. C. Card No. Mic 58-5491)

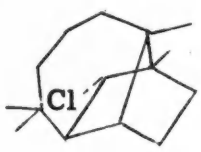
Robert Allan Scherrer, Ph.D.
University of Illinois, 1958

The structure of longifolene hydrochloride has been proposed to be I from the X-ray diffraction studies of Moffett and Rogers.[1] Chemical evidence, although incomplete, and molecular rotation data provided by Ourisson and co-workers support the structure II for longifolene.[2] As a proof of the structure of longifolene, its synthesis was undertaken.

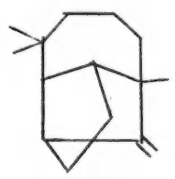
The principal effort was directed toward the synthesis of cis-π-(β,β-dimethylacrylyl)camphor (III), which would be expected to cyclize under Michael conditions to the tricyclic diketone (IV), ketolongicamphor. It was found that cyclization occurred in an unexpected manner to give the tricyclic alcohol V. The diketone III was cyclized by p-toluenesulfonic acid or boron trifloride etherate to an unidentified product $C_{15}H_{22}O_2$ having a single carbonyl (infrared absorption at 1770 $cm.^{-1}$) and no hydroxyl group.

cis-π-(β,β-Dimethylacrylyl)camphor was synthesized from D-α-bromocamphor in ten steps. trans-π-Bromocamphor was prepared from α-bromocamphor by a bromination and selective debromination and converted to π-bromotricyclene by way of the hydrazone. Ring opening of the tricyclene with formic acid gave a mixture of L-cis-π-bromoisobornyl formate and D-trans-π-bromoisobornyl formate which was oxidized directly to cis- and trans-π bromocamphors (ca. 1:1). This was followed by conversion to the ethylene ketal and thence to the cyanoethylene ketal. cis- and trans-π-Cyanocamphor ethylene ketals

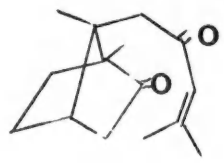
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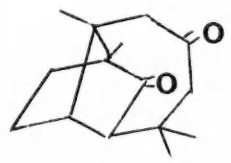
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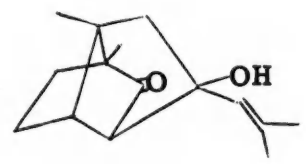
II



III



IV

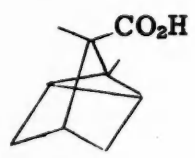


V

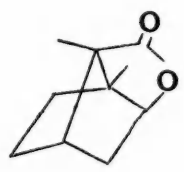
reacted with methallyl magnesium chloride to give the imine which was then hydrolyzed in two steps to III.

π-Bromotricyclene provides a ready route to other tricyclene derivatives, a number of which have been prepared through the Grignard reagent or by displacement of the bromide.

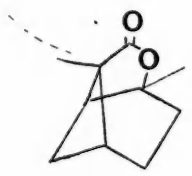
Unexpected ring-opening reactions of some of the substituted tricyclenes were found. Whereas teresantalic acid (VI) gives the lactone VII on treatment with formic acid, the homologous acid does not give the corresponding δ-lactone, but leads to another γ-lactone. Tricyclene derivatives having a carbonyl alpha to the pi position lead on reaction with organic acids, to cyclization products involving the carbonyl function rather than the expected addition products.



VI



VII



VIII

The π-substituted tricyclenes which react normally with acids to give isobornyl esters provide a useful route to the hitherto unknown cis-π-substituted camphors. Saponification of the esters and oxidation, or if a formate, direct oxidation, leads to the π-substituted camphors. (π-Bromotricyclene gives an ether by-product by the former procedure.)

The sesquiterpene α-santalene is now readily available in pure form for the first time by reaction of π-bromotricyclene Grignard reagent with γ,γ-dimethylallyl mesitoate.[3] The alternate approach of reaction with γ,γ-dimethylallyl bromide leads to a mixture of sesquiterpenes.

The structure of the Müller lactone (obtained from teresantalic acid by treatment of the hydrochloride addition product with base) has been verified as a β-lactone.

A new C_{10} tricyclic γ-lactone was found during the preparation of teresantalic acid by mercuric oxide oxidation of the hydrazone of trans-π-apocamphor-7-carboxylic acid. If the structure proposed is correct (VIII) its formation probably comes about by a reversal of the pinene to camphane rearrangement.

Microfilm $2.00; Xerox $5.60. 115 pages.

1. R. H. Moffett and D. Rogers, Chem. and Ind., 1953, 913.

2. G. Ourisson, Bull. soc. chim., France, 1955, 895 and preceding papers.

3. E. J. Corey, S. W. Chow and R. A. Scherrer, J. Am. Chem. Soc., 79, 5773 (1957).

POLYMERIZATION REACTIONS OF ITACONIC ACID AND ITS DERIVATIVES

(L. C. Card No. Mic 58-5494)

Thomas Hugh Shepherd, Ph.D.
University of Illinois, 1958

This investigation was undertaken to determine conditions for both the homopolymerization of itaconic acid and some of its derivatives, and the copolymerization of these materials with various other monomers.

A homopolymer of itaconic acid was prepared in aqueous solution using an acid side recipe, under free radical conditions. Itaconic acid was also copolymerized with acrylic acid and aconitic acid in aqueous solution. The copolymerization of aconitic acid and acrylic acid has also been effected. Polyitaconic acid, and the copolymers of itaconic acid and aconitic acid, itaconic acid and acrylic acid, and aconitic acid and acrylic acid, are extremely water soluble, and form tough transparent films. Inherent viscosities of dilute aqueous solutions of these poly-acids exhibit the "poly-electrolyte effect," that is, the inherent viscosities rise asymptotically as infinite dilution of solution is approached. Molecular weights of these polymers range from about 5×10^4 for the itaconic acid-aconitic acid copolymer, to about 10^6 for the itaconic acid-acrylic acid copolymer.

Copolymers of itaconic acid and aconitic acid, itaconic acid and acrylic acid, and aconitic acid and acrylic acid, were evaluated as soil conditioners, and were found to be not as effective as "Krilium," a commercial product.

A copolymer of butadiene and itaconic acid, containing about 20 per cent of the acid by weight, was prepared in an emulsion system. This polymer exhibits typical elastomeric properties.

Homopolymers of dimethyl, diethyl, and di-n-butyl itaconate were prepared in emulsion systems. These are transparent, thermoplastic materials having higher molecular weights than those previously reported for homopolymers of these esters. The copolymerization of dimethyl itaconate and butadiene was carried out to yield polymers containing various amounts of the ester. The properties of these polymers were determined, and the composition of the copolymers has been established.

The preparation of poly-2-hydroxyethylallyl alcohol by the reduction of polydimethyl itaconate with lithium aluminum hydride was accomplished. A butadiene-2-hydroxyethylallyl alcohol copolymer was also prepared by the reduction of a butadiene-dimethyl itaconate copolymer.

No evidence could be obtained for the homopolymerization of either bis-(N,N-dimethyl)itaconamide or itaconamide under free radical or anionic conditions. When treated with sodium in liquid ammonia, bis-(N,N-dimethyl)itaconamide underwent a rearrangement to bis-(N,N-dimethyl) mesaconamide. These amides did not enter into copolymerization reactions with acrylamide, acrylic acid, methyl acrylate, or diethyl itaconate.

Microfilm $2.00; Xerox $4.80. 94 pages.

I. CHAIN TRANSFER CONSTANTS OF VINYL ESTERS II. ALKYL DITHIOACRYLATES

(L. C. Card No. Mic 58-5503)

Clifford Francis Thompson, Ph.D.
University of Illinois, 1958

I. The molecular weights of addition polymers may be related to the polymerization conditions by the equation

$$1/P_n = C_M + C_s\,(S)/(M) + C_I\,(I)/(M) + \frac{k_t R_p}{k_p^2 (M)^2}$$

where P_n represents the number average degree of polymerization, (S), (M), and (I) represent the concentrations of solvent, monomer, and initiator, and R_p represents the rate of polymerization. The chain transfer constants C_M, C_s, and C_I are the ratios $k_{Tr,M}/k_p$, $k_{Tr,s}/k_p$ and $k_{Tr,I}/k_p$, or the ratios of rate constants for transfer to the rate constant for propagation.

Chain transfer constants for solvent were determined for transfer between toluene and the monomers vinyl acetate, vinyl pelargonate, and vinyl stearate. It was found possible to use weight average degrees of polymerization, determined by light scattering measurements, in place of number average degrees of polymerization. This results from the fact that termination of growing chains by transfer gives a polymer with a narrow molecular weight distribution, and this distribution appears to be constant over a wide range of solvent concentrations. Thus the equation $P_w/P_n = K$ has been postulated, relating the weight and number average degrees of polymerization to a constant with a value between one and two.

The transfer constant found from weight average data has been defined as C_s', and is closely representative of the true constant, C_s, if K has the maximum value of two. In the case of vinyl acetate polymerized in the presence of toluene at 60°C., C_s is about 2.2×10^{-3}, and C_s' about 1.8×10^{-3}. Comparing vinyl acetate, vinyl pelargonate ($C_s' = 1.4 \times 10^{-3}$), vinyl stearate ($C_s' = 2.0 \times 10^{-3}$) and styrene ($C_s = 0.012 \times 10^{-3}$), it was shown that the vinyl esters have practically equal activity in the transfer reaction, signifying that the length of the acyl portion has little, if any, effect on reactivity. The results of Arrhenius plots showed that the greater reactivity of vinyl esters compared to styrene is due entirely to the lower activation energy for transfer with the former.

Although the vinyl esters transferred with solvent at equal rates, the long chain monomers allowed greater transfer with monomer. Thus polyvinyl acetates were always of higher degree of polymerization than stearates, and pelargonates were intermediate.

II. Four synthetic routes were utilized in an attempt to prepare methyl dithioacrylate. Methyl dithiopropionate was prepared by forming an intermediate thioimidopropionate hydrochloride from propionitrile, methyl mercaptan, and hydrogen chloride. This intermediate reacted with hydrogen sulfide in pyridine to give the desired methyl dithiopropionate.

Although the intermediates were readily formed, α-methyl-α β-dibromopropionitrile and β-acetoxypropionitrile could not be converted to the corresponding substituted dithio esters. Methyl dithiopropionate did not undergo the Mannich condensation to yield vinyl substitution on the alpha carbon. Vinyl magnesium bromide reacted with carbon disulfide and methyl iodide in tetrahydrofuran, but the only dithio ester recovered was a small amount of methyl dithiopropionate.

Microfilm $2.00; Xerox $4.60. 89 pages.

POLYMERIZATION REACTIONS OF NON-CONJUGATED DIOLEFINS

(L. C. Card No. Mic 58-5513)

Robert Duval Vest, Ph.D.
University of Illinois, 1958

1,6-Heptadienes which have electronegative substituents in the two and six positions, members of a new class of monomers have been synthesized and polymerized. It was of interest to determine whether these monomers would polymerize by a cyclic, intramolecular-intermolecular mechanism and what effect the incorporation of a cyclic unit in a polymer chain would have on the physical properties of that polymer. A 2,5-substituted 1,5-hexadiene and a 2,7-substituted 1,7-octadiene were also prepared and polymerized in an effort to determine the feasibility of forming five and seven membered rings in a polymerization reaction.

Tetraethyl 1,1,5,5-pentanetetracarboxylate, prepared from diethyl malonate and 1,3-dibromopropane, was hydrolyzed with ethanolic potassium hydroxide to diethyl α, α'-dicarboxypimelate. Diethyl α,α'-dicarboxypimelate reacted with secondary amines and formaldehyde to give a Mannich base which decomposed spontaneously at room temperature with the evolution of carbon dioxide and the secondary amine and subsequent formation of diethyl α,α'-dimethylenepimelate. Dimethyl α,α'-dimethylenepimelate, prepared by an analogous series of reactions, was found to be a more easily purified monomer because of its crystalline nature.

2,6-Dicyanoheptadiene-1,6 was prepared in the following manner after several other synthetic routes failed. Diethyl α,α'-dimethylenepimelate was hydrolyzed to α,α'-dimethylenepimelic acid which was treated with thionyl chloride and then cold ammonia to form α,α'-dimethylenepimelamide. The latter was dehydrated with benzene sulfonylchloride in pyridine solution to the dinitrile.

Diethyl α,α'-dimethyleneadipate and diethyl α,α'-dimethylenesuberate were prepared by a series of reactions analogous to those described for the substituted pimelates starting with the appropriate dibromide.

Tetraethyl 1,5-diphenyl-1,1,5,5-pentanetetracarboxylate and α,α'-diphenylpimelic acid were prepared as intermediates in the synthesis of 2,6-diphenylheptadiene-1,6.

Poly-diethyl α,α'-dimethylenepimelate and poly-dimethyl α,α'-dimethylenepimelate, prepared by emulsion or solution techniques were soluble polymers which contained no residual unsaturation. The above observations indicated that these monomers polymerized exclusively by the alternating intra-molecular-inter-molecular mechanism; further proof that the polymer chain contained carbocyclic recurring units was evidenced by partial dehydrogenation of poly-diethyl α,α'-dimethylenepimelate with potassium perchlorate to a degraded substance which, according to spectral data, contained aromatic rings. On

heating to temperatures above 275°, poly-diethyl α,α'-dimethylenepimelate partially lost the elements of carbon dioxide and ethylene and formed a polymer containing anhydride groups. Poly-dimethyl α,α'-dimethylenepimelate was a high molecular weight (ca. 200,000) polymer which melted above 300° and was stable at temperatures where poly-methyl methacrylate, a functionally similar polymer, depolymerized. Poly-α,α'-dimethylenepimelic acid, prepared by solution polymerization techniques, was soluble in dilute base and did not melt below 400°. The incorporation of a ring into a polymer chain apparently adds considerable thermal stability. Under conditions of bulk polymerization both of these dienes gave clear disks containing varying amounts of crosslinked polymer.

Poly-2,6-dicyanoheptadiene-1,6, prepared by emulsion or solution techniques, was a high molecular weight polymer soluble in hot dimethylformamide. The polymer contained a small amount of residual unsaturation indicating that a portion of the monomer was incorporated into the polymer chain by a non-cyclic process. The thermal stability of poly-2,6-dicyanoheptadiene-1,6 was found to be better than that of poly-methacrylonitrile.

Crosslinked, insoluble polymers were obtained when diethyl α,α'-dimethyleneadipate and diethyl α,α'-dimethylenesuberate were polymerized by bulk techniques but a soluble polymer was obtained from the latter under conditions of solution polymerization.

Copolymers of dimethyl α,α'-dimethylenepimelate with acrylonitrile and with methyl acrylate were soluble while copolymers of 2,6-dicyanoheptadiene-1,6 with acrylonitrile and with methyl acrylate were predominantly insoluble, crosslinked polymers. The formation of a cyclic unit in a copolymerization reaction of diolefins with monoolefins depends largely on the relative reactivity of the two monomers in question.

Microfilm $2.00; Xerox $5.80. 119 pages.

A STUDY OF THE REACTION OF ALKYL HALIDES WITH ALKALI NITRITES IN DIMETHYLFORMAMIDE

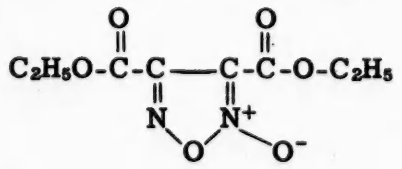
(L. C. Card No. Mic 58-3206)

William Michael Weaver, Ph.D.
Purdue University, 1958

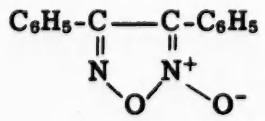
Major Professor: Nathan Kornblum

Although the reaction of alkyl halides with sodium nitrite in dimethylformamide (DMF) at 25° provides a very useful method for the synthesis of aliphatic and alicyclic nitro compounds it fails with ethyl bromoacetate and benzyl bromide.

The reaction of ethyl bromoacetate with sodium nitrite occurs rapidly in DMF but the product is not ethyl nitroacetate; instead, depending on the temperature, oxalic acid or the dicarbethoxy furoxane I is produced. Treatment of



I



II

benzyl bromide with sodium nitrite yields benzoic acid as the main product at 25° whereas at -16° phenylnitromethane is obtained in 55% yield; even at -16°, prolonged standing of the reaction mixture gives the diphenyl furoxane II. Evidence is presented for the view that nitrolic acids are intermediates both in the formation of carboxylic acids and furoxanes. The factors controlling the rate at which aliphatic nitro compounds are destroyed by the joint action of a nitrite ester and sodium nitrite are discussed.

The reaction of alkyl halides with sodium nitrite in DMF does not exhibit clean second order kinetics. However, the addition of ethylene glycol to the extent of 3% (by volume) results in clean second order kinetics. Similarly, in the presence of 2.5 moles of sodium perchlorate per mole of sodium nitrite clean second order kinetics are observed. An explanation for these facts, which is predicated on the assumption that "ion pairs" and higher aggregates of sodium and nitrite ions are present, is proposed.

Sodium nitrite has a limited solubility in DMF and, therefore, in the reaction of alkyl halides with sodium nitrite, urea is often added to increase the solubility of sodium nitrite. With the more soluble lithium nitrite, urea is not needed and it has now been found in the reaction of benzyl bromide with lithium nitrite that urea causes an increase in the yield of phenylnitromethane and a decrease in that of benzyl nitrite. An explanation is offered.

Microfilm $2.75; Xerox $9.40. 210 pages.

THE PREPARATION AND PROPERTIES OF FLUORINATED EPOXIDES

(L. C. Card No. Mic 58-3208)

Vincent Gerard Witterholt, Ph.D.
Purdue University, 1958

Major Professor: E. T. McBee

The following work was undertaken to gain some insight into the preparation, properties, and reactions of highly fluorinated epoxides.

It was found that diazomethane reacts with fluorinated carbonyl compounds including aromatic ketones containing one perfluoroalkyl group, aliphatic ketones containing one or two perfluoroalkyl groups directly attached to the carbonyl group, and perfluoroaldehydes to give primarily the corresponding 1,2-epoxides. Epoxides prepared in this manner were 1-perfluoromethyl-1-phenylepoxyethane, 1-perfluoroethyl-1-phenylepoxyethane, 1-perfluoropropyl-1-phenylepoxyethane, 1,1-bis-(perfluoropropyl)-epoxyethane, 1-methyl-1-perfluoromethylepoxyethane, 1-ethyl-1-perfluoromethylepoxyethane, 1-perfluoromethyl-1-propylepoxyethane, 1-methyl-1-perfluoroethylepoxyethane, 1-ethyl-1-perfluoroethylepoxyethane, 1-perfluoroethyl-1-propylepoxyethane, 1-methyl-1-perfluoropropylepoxyethane, 1-ethyl-1-perfluoropropylepoxyethane, 1-perfluoropropyl-1-propylepoxyethane, 1-perfluoroheptylepoxyethane.

The reaction of 1,1-bis-(perfluoropropyl)-epoxyethane with lithium aluminum hydride, hydrogen bromide, methylmagnesium bromide, methylmagnesium iodide, ammonia and diethylamine gave 4-methyl-tetradecafluoro-4-heptanol, 4-bromomethyl-tetradecafluoro-4-heptanol, 4-iodomethyl-tetradecafluoro-4-heptanol, 1,1-bis-(perfluoropropyl)-aminoethanol, and 1,1-bis-(perfluoropropyl)-diethyl-

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

aminoethanol. Attempts to dehydrate 4-methyl-tetradecafluoro-4-heptanol with sulfuric acid, phosphorus pentoxide, and alumina were unsuccessful. Attempts to brominate 4-methyl-tetradecafluoro-4-heptanol and to replace the hydroxyl group by halogen with phosphorus halides failed. The sodium salt of 4-methyl-tetradecafluoro-4-heptanol with p-toluenesulfonyl chloride in dioxane afforded a stable, tertiary p-toluenesulfonate. 4-Bromomethyl-tetradecafluoro-4-heptanol was converted to 1,1-bis-(perfluoropropyl)-epoxyethane with dilute sodium hydroxide and to 4-methyl-tetradecafluoro-4-heptanol by hydrogenolysis in the presence of palladium on charcoal at autogenous pressures.

Alpha-(perfluoromethyl)-styrene, alpha-(perfluoroethyl)-styrene, alpha-(perfluoropropyl)-styrene, 2-ethyl-3,3,4,4,5,5,5-heptafluoro-2-pentene, and 2-perfluoroethyl-2-pentene were obtained by the ring cleavage of the corresponding 1,2-epoxides with triphenylphosphine in the presence of hydroquinone. Heptafluorobutyrophenone on treatment with triphenylphosphinemethylene gave alpha-(perfluoropropyl)-styrene which added bromine to give the dibromide. Microfilm $2.00; Xerox $5.40. 110 pages.

CHEMISTRY, PHARMACEUTICAL

THE HALF-WAVE POTENTIALS OF ANTIOXIDANTS

(L. C. Card No. Mic 58-3926)

Robert A. Nash, Ph.D.
The University of Connecticut, 1958

The purpose of this investigation was to advance the importance of the oxidation potential of antioxidants in pharmaceuticals, by presenting the half-wave potentials, $E_{1/2}$, for a representative number of antioxidants and related compounds.

Polarography with wax-impregnated graphite electrodes was adapted for use with a manual polarograph. Polarograms at concentrations of 0.1 millimolar for each compound were run in aqueous or aqueous alcohol pH 7.0 buffered solutions at 25 ± 0.5°C. Half-wave potentials, diffusion currents, and alpha values are reported for a total number of sixty-one antioxidants and related compounds.

Sixteen compounds were employed to establish two relationships among four different oxidation potentials. One correlation was demonstrated for the half-wave potential vs. the standard oxidation potential and another for the decomposition potential vs. the critical oxidation potential. Factors affecting their experimental variability were discussed.

A correlation was established between the half-wave potential and the antioxygenic efficiency index of twenty-four of the more important antioxidants. The greatest antioxygenic index for activity is found in the standard oxidation potential region between 700 and 980 millivolts vs. N. H. E. Structure vs. half-wave potention comparisons for antioxygenic efficiency are depicted for five small groups of compounds.

Recommendations are made for the use of ten antioxidants in pharmaceuticals and for eight antioxidants in commercial non-edible preparations. These compounds are proposed on the basis of the potential vs. efficiency correlation previously established.

The speed and precision with which half-wave potential measurements may be obtained makes them ideally suited for the prediction of the efficiency index of an antioxidant.

Microfilm $2.00; Xerox $4.20. 76 pages.

SEPARATION AND INVESTIGATION OF THE MINOR ALKALOIDAL CONSTITUENTS OF SCHOENOCAULEN OFFICINALE

(L. C. Card No. Mic 58-5377)

Glenn Richard Svoboda, Ph.D.
The University of Wisconsin, 1958

Supervisor: Assistant Professor Hyman Mitchner

This investigation deals with the separation and identification of the minor alkaloidal constituents of Schoenocaulen Officinale (Sabadilla). A study of possible separation procedures, partition or adsorption chromatography and countercurrent distribution demonstrated that countercurrent distribution was the best technique for the separation of the alkaloidal mixture.

Starting materials consisted of either previously isolated fractions from Sabadilla or Veratrine, a commercially available preparation consisting of the alkaloids of Sabadilla. A study of the composition of Veratrine by countercurrent distribution indicated that there existed a batch-wise variation, especially of the minor components. The percentage composition of known constituents in the samples of Veratrine analyzed were:

Veratridine	27.3 - 29.4
Cevadine	44.9 - 45.2
Vanilloyl cevine	1.7 - 3.9
Cevacine	0.5 - 5.2
Sabadilline	1.8 - 4.8
Sabatine	2.3 - 3.7
Veracevine	2.2 - 4.8
Sabine	0 - 0.3

Evidence was obtained for the existence of at least eight new minor components of which two were obtained in a crystalline form. Three of the minor components exhibited a maximum absorption in the ultraviolet at 238 mu and were designated as sabadillines I, II and III. Sabadilline II was obtained crystalline and assigned the formula $C_{27}H_4O_7N$. The second crystalline compound, C-I, did not show any ultraviolet absorption. Both crystalline materials did show an infrared band at 6.1 u. On the basis of the infrared and ultraviolet data, sabadilline I was assigned an α,β-unsaturated ketone structure and C-I was assigned an isolated carbon-carbon double bond.

An attempt was made to determine if there existed a relationship between sabadillines I, II and III. Treatment of each of the substances under alkaline isomerization conditions and countercurrent distribution of the products of reaction failed to establish a correlation.

Microfilm $3.35; Xerox $11.40. 260 pages.

CHEMISTRY, PHYSICAL

THE DETERMINATION OF THE WETTING CHARACTERISTICS OF STARCHES AND OTHER POLYMERS AS MEASURED BY CONTACT ANGLES

(L. C. Card No. Mic 58-5387)

Jack Roger Anderson, Ph.D.
University of Illinois, 1958

The wetting characteristics of films of amylose, amylopectin, polyvinyl alcohol, ethyl amylose, amylose butyrate, polyvinyl butyral, polyvinyl chloride, polyvinyl carbazole, polystyrene, polyethylene, Kel-F, Teflon, Lucite, polymethyl α-chloroacrylate, 3,3-bischloromethyl oxetane, and Mylar were determined by measurement of advancing and receding contact angles of water and selected organic liquids. The first three polymers listed have common structural characteristics and their wettabilities were found to be nearly similar; increasing slightly in the order amylopectin, amylose, polyvinyl alcohol. In general, the wetting behavior of the various synthetic polymers could be correlated with chemical constitution and stereo factors.

For each polymer studied it was found that a linear relationship held between the cosines of the contact angles of the liquids and the surface tensions of the respective liquids. Exceptions were the points for certain unstable liquid-polymer systems in which there was evidence of swelling and/or solubility effects; also the contact angles formed by methylene iodide did not fit the linear relationship, although such angles were stable. The slope and the intercept value (at $\cos \Theta = 1$) of the linear relationship for each polymer is of considerable value, both from an interpretative standpoint as well as from a practical standpoint.

The opposite surfaces of foils of the polymers showed marked differences in their wetting properties. (Foils were prepared by casting polymer solutions on various support surfaces and, after evaporation was complete, stripping the foils off). These results were interpreted as being due to changes in the surface concentration of polar groups of the polymer molecules under the orienting influence of the surface of each particular support substance, i.e., the polar groups contained in these polymers underwent induced orientation at the solution-solid interface and were "frozen in" during the solidification of the foil. To illustrate, foil surfaces formed in contact with mercury or glass possessed significantly high free surface energies, whereas, those formed in contact with Teflon possessed abnormally low free surface energies. The orientability depended greatly upon steric factors.

Hysteresis of the contact angle was observed consistently for all systems studied. Differences in the magnitudes of the hysteresis for different liquid-polymer systems were pointed out and discussed.

Changes in the wetting properties of films of amylose, amylopectin, polyvinyl alcohol, amylose butyrate, ethyl amylose, Lucite, polyvinyl chloride, polystyrene, Kel-F, Teflon, polyethylene, and Mylar were produced by exposing the films to the glow discharge surrounding the brush electrode of a Tesla coil. It was found that the treated surfaces exhibited a marked increase in wettability; the effect, however, was not permanent, since the contact angles gradually increased with time following the treatment, Cleaning with detergent partially eliminated the effect, whereas, polishing the surface with alumina completely eliminated it. The Tesla coil treatment is believed to produce dehydrogenation of the polymer surface and this is followed by oxidation of the surface, probably at the sites of the unsaturation, to yield carbonyl groups. Infrared analyses carried out on sparked polyethylene foils correlated with the contact angle results and were consistent with the above interpretation since an increase in infrared absorption at 1710 and 1640 cm^{-1} resulted from the Tesla treatment; and carbonyl absorption and C = C vibrations are known to occur here. Microfilm $2.00; Xerox $5.60. 115 pages.

THE RADIATION CHEMISTRY OF SOME LOW MOLECULAR WEIGHT ORGANIC SOLVENTS

(L. C. Card No. Mic 58-5266)

Ernest Frederich Blase, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Dwight C. Bardwell

The radiolysis of methyl alcohol, methyl isobutyl ketone and diethyl ether by Co-60 gamma rays and by X-rays was investigated. Radiolysis products boiling below 140° C were identified and G values (molecules reacted or formed per 100 electron volts of energy absorbed) were determined. The effects of total dose on G values of a number of products were studied for energy absorptions from 1×10^{21} ev gm^{-1} to 1×10^{22} ev gm^{-1}. Average G values for a number of the radiolysis products are presented below. The complete list of radiolysis products identified and the average G values of these products for the three solvents studied are found in Table I. Included in this study were the design, construction and calibration of a 375 curie Co-60 irradiation facility, the calibration of a 150 KV constant potential X-ray unit and the calibration and modification of a gas chromatograph.

A. Methyl Alcohol

Radiolysis of liquid methyl alcohol yielded hydrogen (G=7.10) and methane (G=1.92). Much smaller amounts of carbon monoxide and dimethyl ether were also found. The identified radiolysis products amounted to 0.63 per cent by weight of the original sample after an energy input of 7.5×10^{21} ev gm^{-1}. The G value for polymer based on the number of molecules of methyl alcohol reacted is 6.5. Polymeric products amounted to 3.26 per cent by weight of the original sample. Research done elsewhere in 1951 (10), in which the ionizing radiation was particulate (27 Mev helium ions) disclosed these products and demonstrated that the polymeric material consisted of aldehydes and glycols.

The present studies are in agreement with the 1951 research which showed that when aliphatic alcohols are irradiated, 90 per cent of the primary process occurred at the carbon atom to which the hydroxyl group was attached. The G value for dimethyl ether found in this study is about three times that found in the previous study. This allows a better stoichiometric balance of water and dimethyl ether according to the equation $2\ ROH \rightarrow ROR + H_2O$.

B. Methyl Isobutyl Ketone

Radiolysis of liquid methyl isobutyl ketone yielded hydrogen (G=3.30), carbon monoxide (G=2.61), methane (G=4.42), acetone (G=1.09), ethyl alcohol (G=1.00), and a high boiling polymer (G=2.0) as principal products. Ethane, propane, propylene, isobutane, normal butane, butene-1, butene-2 cis and acetaldehyde were also identified as radiolysis products. The identified radiolysis products amounted to 3.33 per cent by weight and the polymeric material amounted to 3.38 per cent by weight, respectively, of the original sample after an energy input of 7.5×10^{21} ev gm^{-1}. It is evident that this molecule is exhibiting several behaviors. The relatively large yield of carbon monoxide is accompanied by correspondingly large yields of hydrocarbons, namely, isobutane, methane, propane and propylene. The yields of acetone and ethyl alcohol are significant as evidence for a selective mechanism in the degradation. The large amount of carbon monoxide formed during the radiolysis indicates the behavior of the carbonyl group in irradiated ketones is similar to the behavior of the carbonyl group in irradiated esters. As neither methyl propyl ketone or isovaleraldehyde were present in the irradiated methyl isobutyl ketone, a specific origin of the methane is not disclosed.

C. Diethyl Ether

Radiolysis of liquid diethyl ether yielded ethyl alcohol (G=8.6), crotyl alcohol (G=4.0), hydrogen (G=5.51), ethane (G=2.93), and methane (G=1.21) as the principal products. Acetone, propionaldehyde and acetaldehyde were identified in lesser, though appreciable, amounts. The identified products amounted to 11.5 per cent by weight of the original sample after an energy input of 1×10^{22} ev gm^{-1}. The high boiling polymer products (G=4.4) amounted to 5.42 per cent by weight of the original sample.

Ethyl alcohol results stoichiometrically from diethyl ether by extraction of ethylene. Crotyl alcohol may be similarly considered stoichiometrically as the loss of hydrogen from diethyl ether. Other stoichiometric relationships between diethyl ether and the radiolysis products may be postulated. A general conclusion may be made that the C-O bond is selectively affected in the radiolysis. Evidence for this is found in the large yield of ethyl alcohol and ethane. Supporting evidence may be inferred from the large yield of crotyl alcohol if a condensation of acetaldehyde is the mechanism for the crotyl alcohol formation.

It does not appear certain what mechanisms are prevailing. However, since rather extensive rearrangements are involved, it is possible that the necessary mobility is supplied in ion-molecule groups as well as conventional free radical reactions.

Microfilm $2.00; Xerox $5.80. 120 pages.

A MASS SPECTROMETRIC STUDY OF THE THERMAL DECOMPOSITION OF AZOETHANE AT LOW PRESSURES

(L. C. Card No. Mic 58-3940)

William Dempsey Clark, Ph.D.
University of Oregon, 1958

Adviser: D. F. Swinehart

This work was undertaken with a twofold purpose in mind. First was the construction of a mass spectrometer suitable for use as an analytical instrument in continuously following a gas phase reaction by means of recording its mass spectrum. This also involved fabrication of other equipment such as a thermostat with electronic temperature controlling equipment and over one hundred gas leaks for use in different pressure ranges.

The second purpose was the application of the equipment to kinetic studies concerning the thermal decomposition of azoethane in the gas phase.

Considerable difficulty was experienced in obtaining a pure sample of azoethane. The usual methods of synthesis gave low yields that were contaminated with products of side reaction which were difficult to remove. The method of preparation used gave impurities which were easily removed by distillation and subsequent passing of the product over P_2O_5 in the vapor phase. The method involved the oxidation of sym-diethylhydrazine with mercuric oxide and gave yields of 60% or better after distillation and P_2O_5 treatment. The product was at least 99.99% pure as determined by mass spectroscopy, gas chromatography, and infrared spectra.

The pressure range studied was that between one and 10^5 microns. The temperature range covered the interval 250°C to 310°C in seven 10°C steps.

A total of 151 kinetic runs were made, most of which were followed by measuring the 86 peak of azoethane. Five runs of a mixture of 90% toluene and 10% azoethane were made at 310°C. Packed flask runs, in which the surface area of the flask was increased by a factor of 20 by packing it with Pyrex wool, were made at 310°C and 270°C. In an effort to obtain information on the mechanism of the reaction, the spectrum from mass 12 to mass 120 was recorded during two runs.

Plots of log (peak height) vs. time for each run gave straight lines for at least two half-lives at high temperatures and pressures. At lower pressures and temperatures, straight lines were obtained for as long as ten half-lives indicating a first order reaction.

A plot of log K vs. log P showed a steeply rising curve from one micron to about 10^3 microns at which point a leveling off occurred until large changes in log P produced smaller and smaller changes in log K indicating K becoming independent of pressure. This evidence points to a unimolecular reaction and is also in keeping with the Hinshelwood-Lindemann theory which predicts a change from first to second order kinetics at sufficiently low pressures.

A value for K_∞ for each temperature was obtained by a plot of 1/K vs. 1/p and extrapolation to infinite pressure. Values for the activation energy and frequency factor were obtained from a least squares fit of log K_∞ vs. 1/T and were equal to 48.5 Kcal. and 5.87×10^{15} per sec. respectively.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The packed flask runs at 310°C and 270°C showed no deviation of K within experimental error from those obtained without packing. This would indicate the reaction to be homogeneous.

The rate constants obtained with a 90% toluene, 10% azoethane mixture did not differ from those obtained with azoethane alone at the same total pressures and temperatures. On the basis of this evidence we conclude: a) that the activation efficiency of a toluene-azoethane collision is about that of a azoethane-azoethane collision and b) that there is no evidence that there is a chain involved in this reaction.

Several runs were made at different pressures and temperatures to obtain material for product analysis. This turned out to be exceedingly complex for the mass spectrometer in that at high pressures as many as 30 compounds were found. Through the use of a Beckman Gas Chromatograph, enough information was obtained to allow some generalizations to be made. At low pressures and temperatures, the products were nitrogen and n-butane in the amounts expected from the following equation,

$$CH_3CH_2N = NCH_2CH_3 \rightarrow N_2 + CH_3CH_2CH_2CH_3$$

Small amounts of ethane, propane, and iso-butane were also found but the total amount present was less than 3%.

As the pressure increased the products became more complex. At the highest pressure and temperature studied as many as 30 compounds, all hydrocarbons, were found. In all cases the amount of nitrogen found was about that of theory, indicating no nitrogen compounds in the products. The general trend seems to be as pressures and temperatures increase, the amount of n-butane decreases which result in an increase in ethane, hexanes, and octanes.

The use of the IBM 704 computer at Los Alamos permitted evaluation of the Kassel integral for the azoethane case. A comparison of experimental data with the curves obtained from the Kassel integral showed excellent agreement down to 10^2 microns. At pressures below 10^2 microns, the data began to fall below the Kassel curve. The best fit to the Kassel curves was obtained with a molecular diameter of 5.5A and 18 oscillators.

Microfilm $2.15; Xerox $7.60. 162 pages.

DERIVATIVE POLAROGRAPHY OF THE ALDOPENTOSES

(L. C. Card No. Mic 58-5286)

John William Haas, Jr., Ph.D.
University of Delaware, 1958

The polarographic behavior of the hydrazone, phenylhydrazone, oxime, semicarbazone and trimethylaminoacetohydrazone derivatives of the aldopentoses in aqueous media is described. Variation in wave height for the different isomers is shown to be caused by differences in stability of the ring form of the derivative.

A method is presented whereby the aldopentoses may be qualitatively and quantitatively determined using the hydrazone derivative. At pH 2.3 the sugars can be determined singly and in pairs with an error of less than 2% for the individual species and from 2 to 10% for the pairs under certain limiting conditions over the concentration range 1×10^{-3} to 2×10^{-2} Molar. Quantitative measurements may be extended to 5×10^{-5} Molar at pH 6.15 for single sugars. Microfilm $2.00; Xerox $5.00. 96 pages.

DERIVATIVE POLAROGRAPHY OF D-GLUCOSE, D-GALACTOSE AND D-MANNOSE

(L. C. Card No. Mic 58-5289)

Robert Grant Hocker, Ph.D.
University of Delaware, 1958

The polarographic behavior of the semicarbazone, hydrazone, phenylhydrazone and oxime derivatives of D-glucose, D-galactose and D-mannose in aqueous media is described. The effects of pH, concentration and mercury pressure on the polarographic waves are discussed. An explanation for the small reduction waves observed for the semicarbazones of D-glucose and D-galactose is based upon the amount of acyclic form of the semicarbazones present in solution.

A polarographic method of analysis based upon the hydrazone derivative of the sugars is presented. For the individual sugars over the concentration range 2×10^{-4} to 1.3×10^{-2}M the accuracy of the method is within 2%. The maximum error for mixtures of D-glucose and D-galactose is from 2 to 3% of the major component over the concentration range 3×10^{-4} to 7×10^{-3}M.

Microfilm $2.00; Xerox $3.80. 68 pages.

STRUCTURES OF POLYMORPHIC FORMS: I. THE CRYSTAL AND MOLECULAR STRUCTURE OF α-PIMELIC ACID

(L. C. Card No. Mic 58-3923)

Mortimer I. Kay, Ph.D.
The University of Connecticut, 1958

The structure of the high temperature phase of pimelic acid has been determined by means of X-ray diffraction techniques. The space group is $P2_1/c$. The unit cell dimensions are: $\underline{a} = 5.68 \pm 0.05$; $\underline{b} = 9.71 \pm 0.02$; $\underline{c} = 22.45 \pm 0.10$ A; $\beta = 136.8 \pm 0.5^0$.

Weissenberg and precession photographs were taken and intensities measured by the visual comparison method.

Zachariasen's method was used to determine phases of some structure factors. These structure factors were used in a bounded ($y = +1/4$ to $-1/4$) Fourier $\underline{b}$ projection, together with some structure factors whose signs were found using information contained in an $Ok\ell$ Patterson map.

The structure was refined by means of the least squares method (three dimensional). $R = 0.20$.

The molecules lie in the cell approximately parallel to the $\underline{c}$ axis near $x = 0.5$. The average plane of the carbon atoms is about 11° from the $\underline{b},\underline{c}$ plane. One carboxyl group is twisted 44° from the carbon atom plane and the other 18° in the opposite direction to a position -8° from the $\underline{b},\underline{c}$ plane.

The molecules of α-pimelic acid are hydrogen bonded at each end, forming a series of "infinite chains." These

hydrogen bonded molecules are related by centers of symmetry. Microfilm $2.00; Xerox $5.20. 102 pages.

THE CATHODIC REDUCTION OF VANADIUM (V) AT A MERCURY COVERED ELECTRODE

(L. C. Card No. Mic 58-3874)

Inez E. McFall, Ph.D.
The University of Oklahoma, 1958

Major Professor: Bernard O. Heston

A suitable electrolytic process for the recovery of uranium and vanadium as solid compounds from ore extracts could prove of commercial interest. R. Q. Boyer has patented a continuous electrolytic process for the recovery of uranium compounds from an acid solution using a cathode of high hydrogen overvoltage. The writer has shown that vanadium compounds can be recovered electrolytically from a neutral or basic solution only at a cathode of high overvoltage.

An electrode was prepared by wetting a clean iron gauze with mercury. The hydrogen overvoltage in dilute sulfuric acid for each electrode was determined, using the direct method. The electrolyses of vanadium (V) solutions were all performed in a compartment cell with a platinum anode immersed in sodium sulfate solution and the iron amalgam cathode in a stirred catholyte of the vanadium (V) solution.

The results of the investigation show that as much as 90 wt. % of the vanadium in solution can be precipitated electrolytically with a current efficiency of 60 %. The production contains 44 wt. % vanadium at an average valence of three but does not represent any simple vanadium compound. Microfilm $2.00; Xerox $3.00. 39 pages.

ELECTRODE POTENTIALS IN FUSED LITHIUM CHLORIDE-POTASSIUM CHLORIDE EUTECTIC. BEHAVIOR OF HALOGEN, IRON AND VANADIUM ELECTRODES.

(L. C. Card No. Mic 58-5474)

John Willard Pankey, Ph.D.
University of Illinois, 1958

The electrochemistries of chlorine, bromine, iodine, iron and vanadium systems were investigated in lithium chloride-potassium chloride eutectic at 450° C. Platinum foils in contact with solutions of platinum (II) were used as reference electrodes. Electrolytic contact was maintained through fritted glass disks. A compartment was designed to allow isolation of an electrode and its atmosphere from other electrodes and their atmospheres. Argon was used to provide an inert atmosphere. Halogen electrodes were prepared by the passage of vapors of the halogen around graphite indicator electrodes in eutectic solutions of the halide in question.

Iron (II) and vanadium (II) ions were produced by anodic dissolution of the respective metals. The respective massive metals were used as indicator electrodes to measure the potentials at various concentrations of divalent ion. Iron (III) and vanadium (III) solutions were prepared by anodic oxidation with graphite rods of eutectic solutions of the respective divalent ions. Potentials at the graphite rods were measured at various ratios of trivalent to divalent ion concentrations.

Standard potentials of the various systems are given for the concentration scales of molarity, molality and mole fraction. Microfilm $2.00; Xerox $4.60. 90 pages.

A STUDY OF THE TERNARY SYSTEM FERRIC CHLORIDE-WATER-DIOXANE AT 25°C.

(L. C. Card No. Mic 58-5297)

Donald A. Pascale, Ph.D.
University of Delaware, 1958

The purpose of this research was to study the ternary system ferric chloride-water-dioxane at 25°C. Phase boundaries were determined by analysis of the saturated solutions and of the binary and ternary compounds which formed. Ferric chloride and dioxane were determined experimentally and water calculated by difference. Three stable ternary and two stable binary compounds were found. These are $2FeCl_3 \cdot 5H_2O \cdot 2(C_2H_4)_2O_2$, $FeCl_3 \cdot 2H_2O \cdot 2(C_2H_4)_2O_2$, $FeCl_3 \cdot 2H_2O \cdot 3(C_2H_4)_2O_2$, $FeCl_3 \cdot (C_2H_4)_2O_2$, and $FeCl_3 \cdot 6H_2O$. A metastable ternary compound, $FeCl_3 \cdot H_2O \cdot 2(C_2H_4)_2O_2$, was also isolated. Portions of the solubility curves are of uncommon shape. No region of liquid phase immiscibility was found.

Microfilm $2.00; Xerox $3.60. 65 pages.

MOLECULAR STRUCTURE INVESTIGATIONS BY ELECTRON DIFFRACTION

(L. C. Card No. Mic 58-3188)

Chintamani Nagesa Ramachandra Rao, Ph.D.
Purdue University, 1958

Major Professor: Robert L. Livingston

The molecular structures of methyl azide and pivalonitrile (α,α-dimethylpropionitrile) have been studied by the sector-microphotometer method. In methyl azide the parameters are found to be: C-N = 1.47 ± 0.02 Å, N_1-N_2 = 1.24 ± 0.01 Å, N_2 - N_3 = 1.12 ± 0.01 Å and ∠CNN = 120 ± 2°. Pivalonitrile has a central C-C distance of 1.460 ± 0.020 Å which may be ascribed at least partly to hyperconjugation. The other parameters are: C-C = 1.540 ± 0.010 Å, C -N = 1.160 ± 0.007 Å and ∠C-C-CN = 109.5 ± 1.5°.

The structures of tin tetrachloride and carbon suboxide have been determined by the visual interpretation of sectored plates. Tin tetrachloride possesses a tetrahedral configuration with a Sn-Cl distance of 2.31 ± 0.01 Å. Within the limits of error of the analysis of the radial distribution curve from sector-visual data, carbon suboxide seems to possess a linear symmetric structure with C-C = 1.28 ± 0.01_3 Å and C-O = 1.16 ± 0.01_3 Å.

The molecular structure of vinylidene chloride has been

investigated by a method which involves the visual interpretation of sectored plates. The results compare favorably with a recent investigation using microphotometer data and are more accurate than the results obtained by the visual interpretation of non-sectored plates.

Microfilm $2.00; Xerox $7.00. 148 pages.

RADIOFREQUENCY SPECTROSCOPY A. ELECTRON SPIN RESONANCE IN FREE RADICALS B. NUCLEAR MAGNETIC RESONANCE IN HETEROCYCLIC COMPOUNDS

(L. C. Card No. Mic 58-5485)

Robert Locke Rutledge, Ph.D.
University of Illinois, 1958

A. ELECTRON SPIN RESONANCE IN FREE RADICALS

A brief history of Electron Spin Resonance (ESR) is given with a discussion of the factors affecting the line shapes and multiplicity of ESR signals. A reflection cavity spectrometer, which was constructed, is described and schematics of most of the electronic apparatus[1] are given.

Two problems were investigated by ESR techniques.

1. The dissociation of dimeric oxidation products of two substituted vinyl alcohols[2] was observed at several temperatures. Table 1 contains the data obtained.

TABLE 1

	Roland's Dimer	Byer's Dimer
Energy of Dissociation (kcal/mole)	18.7	25.8
Dissociation constant at 28° C	1.5×10^{-7}	1×10^{-10}
Line Width (Gauss)	8.9	7.1
g-Value	2.0046	2.0032

2. ESR absorption was detected in u.v. irradiated N-(3-pyridyl)sydnone. It was found that in the dark, following an irradiation of the sample by light shorter than 4300 Å, the absorption increased in amplitude from zero to a constant value in a few hours. This increase in signal intensity approximately follows a second order rate equation. At room temperatures no decrease in signal was noted over several days. However above 60° C the decrease was measurable and followed a first order rate equation. The activation energy for the decay process was found to be about 27 kcal/mole of free electrons.

B. NUCLEAR MAGNETIC RESONANCE IN HETEROCYCLIC COMPOUNDS

Nuclear magnetic resonance in liquids is discussed and the two main phenomena of chemical shift and indirect spin-spin coupling are considered. An electronic sawtooth generator for sweeping the magnetic field is presented with schematics. The remainder of the equipment has been described in an earlier paper by Gutowsky and co-workers.[3]

Spectra for the following series of cyclic compounds are reported (the numbers following each type refers to the ring sizes investigated): Parafins (3,4,5,6), imines (3,4,5,6), N-methyl imines (3,4,5,6), oxides (3,4,5,6), sulfides (3,4,5,6), ketones (4,5,6,7), sulfoxides (4,5,6) and lactones (5,6). Each of the series showed the same general trend in the chemical shift (with respect to an external reference, water) with ring size; the proton chemical shifts increase with ring size in the order $4 > 5 > 6 > \cdots > 3$. The results are compared with other experimental data and an explanation for the observed order is suggested.

Microfilm $2.00; Xerox $3.80. 67 pages.

1. P. J. Frank, Thesis, University of Illinois (1957).
2. R. C. Fuson, E. W. Maynert, Tzi-Lieh Tan, Elmer R. Trumbull, and F. W. Wassmundt, J. Am. Chem. Soc., 79, 1938 (1957).
3. L. H. Meyer, A. Saika and H. S. Gutowsky, J. Am. Chem. Soc., 75, 4567 (1953).

THE TERNARY SYSTEMS COBALT CHLORIDE-DIOXANE-WATER AND NICKEL CHLORIDE-DIOXANE-WATER

(L. C. Card No. Mic 58-5301)

Hans Schott, Ph.D.
University of Delaware, 1958

1. The ternary systems cobalt chloride-dioxane-water and nickel chloride-dioxane-water were investigated at 25°. The two phase diagrams were similar.
2. Increasing amounts of dioxane decreased the solubility of the chlorides in water. Both salts were completely insoluble in pure dioxane, but traces of moisture caused dissolution of small amounts.
3. A region of immiscibility existed at high dioxane concentrations: the second liquid layer consisted of salted-out dioxane containing some water but little salt.
4. The color of the liquid phases of the cobalt chloride system varied as follows with increasing dioxane concentration and decreasing water concentration: wine-red ($Co.6H_2O^{++}$), purple and violet (hexacovalent non-ionic cobaltous chloride complexes), blue (tetracovalent cobalt II).
5. Most solutions of the nickel chloride system were emerald green (hexacoordinated Ni^{++}).
   The techniques used for determining the composition of the solid phases included:
6. A modified method of wet residues. The tie lines were extrapolated through three compositions (liquid phase, initial mixture, wet residue); alignment provided a check on accuracy, and sharper convergence resulted.
7. A material balance when one component was (almost) completely concentrated in one phase.
8. Identity of x-ray powder diffraction patterns.
9. Preparation of the pure, dry solid compounds for direct analysis. This involved (a) growing coarse

enough crystals to remove the adhering mother liquor by blotting with filter paper, or (b) replacing the mother liquor with one containing very little dissolved salt, followed by drying externally at room temperature under vacuum.

10. The hexahydrates were solids in equilibrium with solutions of very low dioxane concentration.
11. The monodioxanates (1:1 adducts) were the solid phases prevailing at very high dioxane concentrations. They were very hygroscopic: in contact with aqueous dioxane, they removed all but 0.2% water. Their thermal stability was remarkable.
12. The two dihydromonodioxanates, $MCl_2 \cdot 2H_2O \cdot C_4H_8O_2$, were the prevalent solid phases over most of the two phase diagrams.
13. During stepwise desolvation at reduced pressure and increasing temperatures, the magenta cobalt chloride dihydromonodioxanate lost its water of crystallization at a lower temperature than it lost the bulk of its dioxane of crystallization.
14. The evolution of water overlapped the evolution of dioxane during the stepwise desolvation of the chartreuse nickel chloride dihydromonodioxanate; extensive hydrolysis occurred.
15. The dioxane probably functioned as a bidentate, in view of the composition of the solid solvates and the coordinating capacity of cobalt and nickel.
16. A mathematical extrapolation of the tie lines for the method of wet residues was developed.

Microfilm $2.70; Xerox $9.40. 206 pages.

THE COORDINATION OF CARBOXYLIC ACIDS WITH OLATED CHROMIC CHLORIDE

(L. C. Card No. Mic 58-5302)

Charles Albert Simpson, Ph.D.
University of Delaware, 1958

Adviser: Cecil C. Lynch

The reaction between olated, one-third basic chromium (III) chloride and carboxylic acids was studied in methanol solution. Some striking differences between the coordination of RCOOH and ArCOOH were shown to occur. The overall order of each reaction is second, but first order with respect to RCOOH, and a fractional order with respect to ArCOOH. The aliphatic complexes have considerably higher formation rates (e. g., 4×10^{-3} vs. 1.4×10^{-3} l. mole^{-1} sec.$^{-1}$) and formation constants (e. g., 200 vs. 7), and an activation energy of 21.2 kcal./mole (vs. 12.4 kcal./mole). The effect of a lower acid pK is to lower the rates and stabilities in the aliphatic series, whereas just the opposite is true of the aromatics. The structure of acetato chromic chloride is best given as: chlorodiaquopentamethanol-μ-acetato-ol-dichromate (III) ion. The structure of benzoato chromic chloride is less certain, but it may involve either singly bound benzoate or a μ-benzoato-diol structure. The rate and formation constants were determined from the amount of carboxylic acid extractable into benzene after various reaction times.

Microfilm $2.00; Xerox $5.00. 97 pages.

THE THERMODYNAMICS OF SODIUM AMIDE AND SELECTED BORON COMPOUNDS IN LIQUID AMMONIA

(Publication No. 22,310)

John Ramsay Sinclair, Ph.D.
Boston University Graduate School, 1957

The usefulness of a systematic thermodynamic approach as an aid in investigating the nature of solvated species has been amply demonstrated in the case of aqueous solutions. The complex polymeric nature of water has, however, greatly hindered the interpretation of the data by introducing the necessity of partitioning observed energy effects between the energy of solvation and the energy necessary to break up "icebergs" of water at unknown distances from the solvated particle.

In order to find a system more amenable to a simple theoretical approach and to extend the theories to solutions in general, chemists have turned to other solvents. Liquid ammonia, as a polar solvent with many water-like properties, has been one of the more thoroughly investigated of these solvents. The virtual absence of polymerization in liquid ammonia permits ready assignment of the solvation energy to the interaction of the solvated species with the solvating shell.

The thermochemistry of small univalent ions in liquid ammonia has been systematically studied and correlated with existing theory. Unfortunately, the paucity of data on large and/or polyvalent ions has precluded the extension of these theories. Furthermore, despite the significance of the role of the alkali amides as the caustic alkalies of the ammonia system, the thermodynamic properties of the amide ion in liquid ammonia have not been unequivocally established.

In order to supplement existing data for ammonous solutions, thereby facilitating both theoretical interpretations and the systematization of chemistry in liquid ammonia, this investigation has been directed toward the determination of the thermodynamic properties of the recently discovered borohydride ion, the large tetramethoxyborate ion, and the amide ion in liquid ammonia.

The heats of solution of both sodium and rubidium borohydride in liquid ammonia at -33°C. were determined. The value obtained for sodium borohydride, in conjunction with known data, permitted the calculation of the heat of formation of the borohydride ion in the standard hypothetical one molal solution. In combination with an estimate of the free energy of solution of sodium borohydride obtained by another investigator in this laboratory, this value also permitted the calculation of the entropy of the borohydride ion in liquid ammonia. The properties of the borohydride ion and of the ions subsequently discussed are recorded in Table I. The heat of formation of the borohydride ion was then combined with the heat of solution of rubidium borohydride for an estimate of the heat of formation of rubidium borohydride.

The heat capacity of sodium tetramethoxyborate was

determined over the temperature range 14°K. to room temperature. The data were used to construct a plot of C_p/T against T and the curve was integrated graphically to obtain the entropy of the solid at five degree intervals up to room temperature. The contribution to the entropy in the range below 14°K. was obtained by fitting a Debye function to the observed heat capacity curve over the range 14 to 30°K. and calculating the entropy from tables of Debye functions. The best fit was obtained with the function:

$$C_p = 2.7\ D\left(\frac{136}{T}\right).$$

The heat of solution of sodium tetramethoxyborate was determined experimentally and the free energy of solution was estimated from available solubility data. These values, combined with the above entropy and other data, permitted the calculation of the entropy of the tetramethoxyborate ion in liquid ammonia.

Two samples of sodium amide were prepared by the reaction of gaseous ammonia with molten sodium and their heat capacities investigated over the range 14°K. to room temperature. The first sample displayed anomalous behavior which could not be explained on the basis of any known type of transition. Repeated attempts to obtain a reproducible curve by changing the rate of cooling and the period of time the sample remained at a given temperature were unsuccessful. A smooth curve from which the entropy could be calculated was obtained by a single continuous run from 14°K. to 240°K., at which temperature the curve coincided with the experimental points from a previous run. The entropy was calculated by a graphical integration of a plot of C_p/T against T and the entropy contribution in the range below 14°K. was again obtained by fitting a Debye function to the experimental heat capacities. These results are recorded in Table II. The best fit was obtained with the function:

$$C_p = \frac{1}{1.6}\ D\left(\frac{143}{T}\right).$$

To verify the peculiar behavior of the first sample, a second sample of sodium amide was prepared and its heat capacity investigated over the range 59°K. to room temperature. No anomalies such as those encountered in the first sample were observed. The entropy was obtained by graphical integration as above and the contribution to the entropy of the range below 59°K. was calculated by fitting a combination of Debye and Einstein functions to the experimental heat capacities over the range 59 to 100°K. and calculating the entropy from tables of Debye and Einstein functions. These values are recorded in Table II. The value obtained on this sample is regarded as more reliable and is used in subsequent calculations. The best fit was obtained with the function:

$$C_p = D\left(\frac{190}{T}\right) + 2E\left(\frac{450}{T}\right).$$

The heat capacity and entropy of sodium amide were combined with available thermodynamic data to calculate the standard free energy of formation and the relative partial molal ionic entropy of the amide ion in liquid ammonia. These properties of the amide ion, in conjunction with available data, permitted the calculation of the equilibrium constant of liquid ammonia as $K_I = 1 \times 10^{-33}$. The thermodynamic properties of the amide ion are recorded in Table I.

TABLE II

Entropy of $NaNH_2$ and $NaB(OCH_3)_4$

	$NaB(OCH_3)_4$	$NaNH_2$ (I)	$NaNH_2$ (II)
Temp. of lowest measurement (°K.)	14.358	14.517	59.061
Function used for extrapolation	$2.7\ D\left(\frac{136}{T}\right)$	$\frac{1}{1.6}\ D\left(\frac{143}{T}\right)$	$D\left(\frac{190}{T}\right)+2E\left(\frac{450}{T}\right)$
Entropy of extrapolated range	0.508	0.102	2.333
Entropy at 298.15 (°K.)	68.60	18.68	18.38

TABLE I

Thermodynamic Properties of Ions in Liquid Ammonia at -33°C.

Ion	ΔH_f^0	ΔF_f^0	$\bar{S}^0$
BH_4^-	-15.0	10.6	-20
$B(OCH_3)_4^-$	-	-	28
NH_2^-	10.0	32.	-21

The entropies of these ions correlated well with the known entropies of ions of similar radius and complexity. This correlation justified the use of established empirical methods to estimate the thermodynamic properties of these ions in water. These values are recorded in Table III. The thermodynamic properties of the borohydride ion estimated in this manner may be compared with the following values obtained by Stockmayer et al for the borohydride ion: $\Delta F_f^0 = 28.6$ kcals; $\Delta H_f^0 = 12.4$; $\bar{S}^0 = 25.5$ e.u.

TABLE III

Thermodynamic Properties of Ions in Water at 25°C.

Ion	ΔH_f^0	ΔF_f^0	$\bar{S}^0$
BH_4^-	13.	26.	23
$B(OCH_3)_4$	-	-	74
NH_2^-	38.	45.7	26

The entropy of solvation of an ion in liquid ammonia can be attributed largely to the entropy changes involved in orienting the solvent molecules of the solvating shell around the ion. In water the formation of the solvating shell is accompanied by a break-up of the polymeric structure of water at some distance from the ion. The decrease in order due to this break-up of the structure of water tends to offset the increase in order in the solvating shell, hence the entropy of solvation of ions in water is less negative than the entropy of solvation of ions in liquid ammonia. The difference is noted in the entropies recorded in Tables I and III. A systematic study of ionic entropies, when reliable data are available, will aid greatly in elucidating the nature of these shells.

As a separate unit of this research, the heats of solution of selected boron hydrides in liquid ammonia have been determined. Numerous structures for the ammoniate of the first member of the series, diborane diammoniate, have been suggested. These have been based largely on the

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

freezing point data, which indicate that the compound exists in a two boron formula, the fact that only the hydrogens on the nitrogens exchange with the hydrogens in ammonia, and the fact that the reaction of diborane with sodium in liquid ammonia liberates hydrogen and forms sodium borohydride and ammonoborane:

$$Na + B_2H_6 \cdot 2NH_3 \xrightarrow[-78^\circ C.]{liq.\,NH_3} {}^1/_2\, H_2 + NaBH_4 + BH_2NH_2$$

Only three structures are currently supported. They are the ammono-acid structure NH_4^+ $(BH_3NH_2BH_3)$, the borohydride salt structure $(NH_3BH_2NH_3)$ BH_4^-, and a structure in which each bridging hydrogen is solvated by ammonia. The last structure would apply readily to all members of the series and would require that the energy of solvation of a bridging hydrogen be approximately constant in all boron hydrides.

It appeared, therefore, that a determination of the magnitude of the energy of solvation of a hydrogen bridge and of the consistency of the value throughout the boron hydride series, would aid in choosing between the several postulated structures. The observed heats of solution were consequently used to calculate the heat of solution of the liquid boron hydrides in liquid ammonia and thus the heat of solvation of a bridging hydrogen for each of the boron hydrides studied. (This calculation assumed that all parts of the molecule other than bridging hydrogens mixed ideally with liquid ammonia.) The results are recorded in Table IV.

TABLE IV

Solvation Energies of the Bridging Hydrogens

Compound	Heat of Solution per Bridging Hydrogen
B_2H_6	-14.6 ± 1.0
B_5H_9	-10.2 ± 0.1
$B_{10}H_{14}$	-11.0 ± 0.2
$B_2H_5N(CH_3)_2$	-22.6 ± 0.5

The value obtained for the dimethylaminodiborane was considered anomalous because of the influence of the $-N(CH_3)_2$ group. The heat of solvation of the bridging hydrogen in the other molecules is of the same order of magnitude as that obtained from crude calculations based on the solvation model and on known and estimated parameters of the boron hydride molecules.

Calculations based on the other structures were precluded by the lack of information on the bond energies involved. It was possible to suggest structures for the ammoniates of the higher boron hydrides based on speculative extensions of the structures suggested for diborane diammoniate. They involved approximately the same process for every pair of bridging hydrogens and hence approximately the same energy effect per bridging hydrogen. It was, therefore, not possible to discard either the borohydride salt or the ammono-acid structures on the basis of existing data.

Microfilm $2.00; Xerox $6.00. 123 pages. Mic 58-5224

THE SCATTERING OF METASTABLE HELIUM ATOMS IN HELIUM, NEON, AND ARGON

(L. C. Card No. Mic 58-3505)

Gordon Meade Smith, Ph.D.
The University of Florida, 1958

Our present knowledge of intermolecular forces has been obtained largely by analyzing experimental determinations of macroscopic properties such as viscosity and diffusion, which depend on these forces. Molecular beam experiments provide a much more direct method of studying these forces. The scattering of a beam of unidirectional particles can be observed by measuring the intensity of the beam as it passes through a gas at a low pressure. The properties of the individual particles can be determined directly in this manner thus eliminating the necessity of relating intermolecular forces to bulk properties.

An apparatus was designed and constructed to perform scattering experiments with an atomic beam of metastable helium atoms in various gases. The atomic beam originated in a thermal source of helium gas in which some of the atoms had been excited to metastable levels by electron impact. The metastable atoms were detected at metal surfaces by observing the ejected electrons. An electric field was used to deflect charged particles from the beam and experiments were performed to show that photons originating in the source were negligible. Normal atoms in the beam did not interfere since the method of detection was not sensitive for them.

A total collision cross section which is the sum of the elastic and inelastic cross sections has been measured for each of the metastable states of helium in helium, neon, and argon. The experimental results and their estimated precision obtained with a source temperature of 66° C. and a scattering gas temperature at 27° C. are given in Table 1.

TABLE I

CROSS SECTIONS
($cm^2 \times 10^{16}$)

Beam Atom	Helium σ_T	Neon σ_T	Argon σ_T	Argon σ_I
2^3S	49 ± 5	50 ± 5	58 ± 9	8 ± 3
2^1S	37 ± 4	29 ± 3	51 ± 7	8 ± 3
Kinetic Theory	14.9	17.8	26.6	

In each case the cross section for the 2^3S state of helium is larger than that for the 2^1S state. In neon this difference is well above the estimated error. Since the inelastic collisions which can occur between a metastable helium atom and a neon atom are of low probability, this difference must be in the elastic part of the cross section and can only be caused by large differences in the interaction forces for the two cases. The ionization cross sections for the two metastable states of helium in argon have been measured and are shown in Table 1. Within the experimental error of the measurements these cross sections are the same. Microfilm $2.00; Xerox $4.20. 78 pages.

ECONOMICS, GENERAL

THE STATUTORY REGULATION OF MINIMUM WAGES IN GREAT BRITAIN

(L. C. Card No. Mic 58-3959)

Roger Louis Bowlby, Ph.D.
The University of Texas, 1958

Supervisor: Professor Frederic Myers

The dissertation is a study in public policy. It attempts an evaluation of minimum wage regulation in Great Britain on the basis of its successes and failures in accomplishing the purposes specified by Parliament during the passage of enabling legislation, the relation of these successes and failures to the general economic climate and the administrative techniques selected for their fulfillment, and the economic consequences of regulation.

Some historical material is introduced to explain why statutory wage regulation was initiated and account for its distinctive forms. The mechanical details of contemporary regulation are presented, including a description of how new boards are established, their composition and powers, the process of decision making within the wage boards, and the relationship of statutory regulation to other forms of British wage determination. The relationship of earnings to minimum rates in the occupations subject to regulation is subjected to statistical analysis, both in terms of the present situation and in terms of historical trends, in an attempt to determine whether or not the minima become effective maxima, and to discover if this relationship has changed over time. The economic consequences of wage regulation are discussed in some detail, with special reference to wages, employment, organization, efficiency, and industrial disputes. Both deductive analysis and empirical evidence as to the impact of regulation are presented, and a reconciliation of the deductive and inductive conclusions is presented. The major conclusions advanced relate to the wage-employment relationship in the regulated industries, the question of whether or not the wage boards have raised wages, and the extent to which they have been successful in promoting collective bargaining.

Thirty-six statistical tables are included, which present factual information about earnings, minimum wage rates, employment, unemployment, disputes, the proportion of female workers, and the proportion of workers paid under piece rate systems in the industries subject to statutory regulation. Appendices include the Acts of Parliament that have contributed to the system, a list of past and present wage boards, and the trade unions concerned with legal wage regulation.

Microfilm $2.95; Xerox $10.20. 227 pages.

UNION-MANAGEMENT HEALTH AND WELFARE PROGRAMS SINCE 1945

(L. C. Card No. Mic 58-5426)

George William Hardbeck, Ph.D.
University of Illinois, 1958

The purpose of this thesis is to investigate and analyse the effects of union-management health and welfare plans on the employer, the employees, and society. The ultimate objective is to ascertain how far these plans should be relied upon to meet the risk on non-job-connected deaths and disabilities. The scope of the study is limited to union-management negotiated health and welfare programs since 1945. The term "health and welfare plans" includes the following kinds or types of plans or benefits: death benefits which includes life insurance, accidental death and dismemberment insurance; temporary disability benefits or income protection insurance; hospital, surgical, and medical benefits. Pensions and/or retirement annuities as such are not analysed in this study, but at times because of the inter-relation of pensions with health and welfare plans, material is presented that concerns both. The cost of private health and welfare plans is contrasted and analysed with the cost of state temporary disability plans in order to reach a better public policy decision on health and welfare programs.

This thesis attempts to answer the following questions. What basic factors should be considered by management and labor in establishing a health and welfare program? What are the economic and social factors that contributed to the recent growth of health and welfare plans? What are the types and present magnitude of collectively bargained plans, and what has been the experience with these plans? In this connection an attempt is made to analyse the effects of health and welfare plans in terms of their economic and social implications for the employer, employees, insurance carriers, and society. Therefore, such factors as the probable effects of health and welfare plans on absenteeism, turnover, wages, hiring practices, medical care, consumer purchasing power, industrial relations are studied.

The main sources relied upon to answer the above questions are the Senate's hearings on "Health and Welfare Plans" and case studies of specific health and welfare plans. Health and welfare plans may be administered in a number of ways. They may be administered by management, union, or union-management. Therefore, three management-administered welfare plans, two jointly administered welfare plans, and one union-administered welfare plan are examined. The size of the organizations studied vary from the very large, i.e., General Motors, to small firms, i.e., a Local Building Trades plan.

The data lead to the following conclusions and recommendations. Health and welfare programs have been established by employers with certain goals or objectives for the plans, e.g., reduce turnover, recruit better

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

employees, etc. Yet, many employers have not ascertained whether the plans have achieved their objectives and do not know whether they have benefited from the plans. The employees have benefited from the welfare plans. They are obtaining benefits at a lower cost than they could purchase as individuals. The welfare plans appear to adjust well to the desires and the needs of the group. The benefits provided under health and welfare programs have tended to reduce the social charge formerly placed upon society. It is concluded that union and management are usually the appropriate parties to provide health and welfare plans. However, there should be Federal Government regulation of welfare plans to see that they operate properly and thus eliminate the abuses that have occurred in welfare plans. This would be beneficial to all parties concerned. It is recommended that some employers be given some financial assistance from the Federal Government for their health and welfare plans because the cost of the plans is in some cases almost prohibitive. This is due to the labor force composition of some firms, and the small size of others. Since health and welfare programs are considered desirable from a public as well as a private point of view, employees and their dependents should be provided protection against the economic risk of non-job-connected deaths and disabilities.

Microfilm $3.15; Xerox $10.80. 242 pages.

BRITISH TRADE CYCLES AND AMERICAN BANK CREDIT: SOME ASPECTS OF ECONOMIC FLUCTUATIONS IN THE UNITED STATES, 1815-1840

(L. C. Card No. Mic 58-3997)

Burke Adrian Parsons, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Wendell C. Gordon

Although apprehension not infrequently arises concerning the effect of general depression in one country on the economy of others, very little economic analysis has been devoted to determining how economic fluctuations are actually transmitted from one country to another. During the period 1815 to 1840 cyclical fluctuations in the United States were concurrent in timing with those in England. Contemporary opinion often attributed the fluctuations to the operations of the banks, asserting that they overexpanded credit bringing about excessive imports and then contracted credit, causing crisis and depression, when export demands for specie arose. This study attempts to determine the manner in which impulses to economic fluctuations were transmitted from the British economy to that of the United States and the part which banks in the United States played in the fluctuations.

An examination of the characteristics of bank credit under conditions of note issue banking and regulation of the currency by the second Bank of the United States is made in order to provide a model of the bank credit mechanism. By means of the model the fluctuations in the volume of bank credit are examined through the monthly statements of the several offices of the second Bank of the United States. Statistics of trade and finance, including specie movements and foreign exchange rates are investigated in order to see whether there is a meaningful pattern in the recurring fluctuations. Contemporary organization and practices of Anglo-American trade are reviewed in order to note their potentialities for transmitting impulses to expansion or contraction.

The expansion phase of each cycle was initiated by an extraordinary increase in the quantity of cotton exported to England. This was followed by increased imports of specie into the United States. Next, in each case, the second Bank of the United States, influenced by larger specie reserves, released the state banks from restraint by expanding its earning assets and its note issues. General credit expansion on the part of the banks followed accompanied by increased imports.

As the expansion proceeded imports increased proportionately more than exports creating a demand for foreign exchange. As a result specie exports occasioned sudden curtailment of the bank credit expansion which brought about a crisis followed by depression. The timing of the crises was most often accounted for, however, by a reduction in the supply of foreign exchange through a fall in the price of American export commodities, particularly in the price of cotton.

From 1815 to 1826 the impulses to expansion and contraction were transmitted mainly through the prices and quantities of goods moving in international trade. The impulse to expansion arose in the British demand for American cotton. The impulse to contraction came about through price declines for American export commodities and, in some cases, through the competition of British goods consigned to the United States and offered at successively lower prices.

After 1826 financial relationships as well as prices and quantities of goods were of some importance in transmitting the impulses to expansion and contraction. There were fluctuations in the volume of British credit financing American imports and in the volume of American securities purchased by British investors.

Microfilm $4.70; Xerox $15.80. 367 pages.

ECONOMIC DEVELOPMENT IN MODERN GREECE: A STUDY OF INSTITUTIONAL RESISTANCES

(L. C. Card No. Mic 58-5092)

George Anthony Spiva, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Professor Erich W. Zimmermann

The role of the government in modern Greece and the culture pattern of the country are considered here in some detail as they bear upon the process of economic development. Because the role of the central government is so essential in the present development schemes of Greece, it is highly desirable that the political history of the modern nation be understood so that political events and maneuvering can be properly evaluated. Economic development is inseparable from politics in Greece, and economic decisions there are apt to be highly influenced by the political tides of the moment--tides which shift with what, to most Westerners, is almost bewildering rapidity.

It is the culture pattern of modern Greece that makes

the Greek the type of person he is today, and his beliefs about the world around him have a direct bearing on his willingness to undertake new ways of doing things in various fields--ways essential to economic progress. Also important, in terms of present-day processes of economic development, is the attitude which the average Greek has toward his government and his readiness to accept the guiding hand of the authorities and to help expedite the plans which the authorities have devised for his benefit.

An examination of the political history of modern Greece and the culture pattern indicate that these two social institutions act and react upon one another to produce an economic climate which makes growth difficult and protracted. The culture pattern produces an attitude of profound distrust for the central government in the minds of most Greeks, and at the same time it insures that a politician in Greece will inevitably act in a fashion which only serves to confirm and reaffirm that distrust. The unique circumstances surrounding Greece's winning independence from the Ottoman Empire set a pattern in Greek politics and Greek thinking which goes far in explaining the chronic instability of Greek politics and the chasm which separates governors from governed.

Because Greece is, in some respects, typical of countries in an in-between stage of development, this analysis of some of the institutional resistances to economic development in that country may prove useful as an approach to development in other countries as well.

Microfilm $4.15; Xerox $14.00. 324 pages.

PROJECT EVALUATION TECHNIQUES FOR FEDERAL MULTIPLE PURPOSE PROJECTS

(L. C. Card No. Mic 58-2581)

Harry Martin Trebing, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Martin G. Glaeser

The economic evaluation of multiple-purpose water resource projects is a complex task, partly because many of the economic effects of a project accrue over long time periods and partly because the effects themselves are diffuse and often intangible. Yet, there must be some basis for decision making and the Federal agencies concerned, principally The Bureau of Reclamation, Corps of Engineers and Federal Power Commission, have developed evaluation techniques that profess to measure the benefits and costs associated with this type of investment. The problem selected in this study is one of appraising the nature of water resource benefits and costs, devising applicable evaluation techniques and then contrasting these techniques with current agency practices to indicate alternatives or corrections.

The evaluation of project functions, such as navigation, irrigation, etc., as well as total going-concern benefits, necessitates abandonment of the conventional market standard of feasibility. In its place, institutional standards representing the public interest must be outlined for each function. Within the context of these standards, benefits and costs arise and evaluation techniques should be capable of treating them. Possible techniques are suggested for navigation, irrigation, hydro power, flood control, water supply and recreation.

To provide a better understanding of current agency practices, the historical development of project evaluation from 1900 to 1957 is outlined. Special attention is given to the formative influence of legislation as well as changes in economic conditions and economic thinking on the role of public works. With this background, agency evaluation techniques are set forth in detail for each major water resource function, together with the criticisms and proposals of congressional committees, advisory groups, and The Bureau of the Budget. This discussion, when taken together with the techniques which we have previously developed, serves as a basis for analysis and recommendations.

Among the principal recommendations, it is suggested that greater attention be given to the net increase in value added resulting from the more balanced, full and efficient employment of resources making direct use of the project. This net increase should represent the additional value added over that which would result had the resources or factors been employed in their next best alternative in the absence of the project. Offsetting costs would include the sacrifice of goods and services involved in undertaking the project and an estimate of the adverse effects on related or competitive activities or areas. This net increased value added is particularly applicable to new waterway traffic moving chiefly because of low water rates, going-concern irrigation communities and low-cost power developments. In the case of navigation and hydro power, it may also be desirable to include the savings over an economic alternative as a benefit, care must then be taken to avoid double counting.

It is also recommended that all benefits and costs be reduced to a comparable time basis by discounting future effects over the economic life of the project function at a rate based upon productivity growth. The productivity rate is an especially desirable means for weighing the comparative worth of present and future goods and services. Although the desirability of using true future prices is noted, constant prices are recommended as a reasonable compromise.

Finally, attention is drawn to the need for abandoning the quantification of secondary effects as well as the need for uniformity in computing capital costs and tax allowances. Consideration should also be given to total going-concern benefits arising independently of the benefits associated with particular functions.

Microfilm $5.15; Xerox $18.40. 402 pages.

ECONOMICS, COMMERCE AND BUSINESS

LEGAL LIABILITY IN PUBLIC ACCOUNTING PRACTICE

(L. C. Card No. Mic 58-5392)

Robert Glen Berryman, Ph.D.
University of Illinois, 1958

The objective of this study is to provide a relatively complete exposition of legal liability in public accounting practice and to review measures which public accountants may appropriately adopt to reduce the risks from this source.

The public accountant who fails to fulfill any duty created by contract or imposed by law with respect to any aspect of an engagement may be subject to legal censure. Clients, third parties or the state may bring actions against public accountants. The complainant may allege a breach of the contract, commission of a tort or violation of a statutory duty. The public accountant owes a duty to his client to perform his contracts without negligence or fraud. He is usually responsible to third parties for fraud but not negligence. If the third party is the client's beneficiary or subrogee, or a person suing under the Federal Securities Act of 1933, he is responsible for both negligence and fraud. The state may initiate prosecution of accountants when they suspect violations of statutes.

As professional men, public accountants' performance of engagements must be at least equal in quality to that which is typical in the profession. The public accounting profession must set the standards of performance before the law can enforce them. Not all auditing standards, techniques or procedures or accounting doctrines have been reviewed by the courts nor have all the possible applications been the subject of litigation. Those concepts which are generally accepted by the profession can be expected to satisfy the courts if the selections were appropriate in the circumstances and were employed skillfully and carefully. Decided cases seem to indicate trends toward (1) increasing the degree of social responsibility of public accountants, (2) requiring full disclosure and (3) raising the quality of performance needed to comply with the due care requirement.

In order to reduce the risk of legal liability in his practice the public accountant should be aware of the hazards which exist and the means available to reduce the likelihood and adverse effects of litigation. In legal actions the public accountant's greatest loss is likely to be that of his reputation. In addition there may be damages awarded by the courts, legal fees and loss of time.

Before accepting engagements the public accountant should be sure that he is fully qualified to render the services needed and has resources available to perform the work properly. He should investigate prospective clients so as to avoid engagements in which the tendency toward bias or the existence of other risks is likely to be great. Carefully worded written contracts or at least an exchange of letters is preferable to an oral contract.

Emphasis in field work should be placed where legal liability is most likely to occur. Work papers should be reviewed carefully to be sure that suspicions and questions are adequately investigated and explained, compliance with standards of performance has been achieved and the evidence obtained justifies the report issued.

The accountant's report should be carefully worded so that the exact meanings intended are conveyed. The scope of the work is all that should be reported as representation of fact. The remainder of the usual report should express opinions. Careful report review should assure full disclosure of all relevant facts. Care should be taken to avoid improper disclosure of confidential information given by the client.

Public accountants should strongly consider carrying professional liability insurance since it can shift a substantial part of the financial risk from legal liability in their professional practice to an insurance company.

Microfilm $5.25; Xerox $18.80. 411 pages.

A HISTORY OF DIRECT MAIL ADVERTISING

(L. C. Card No. Mic 58-5427)

Virgil Eugene Harder, Ph.D.
University of Illinois, 1958

Advertising has become a significant part of the American economy. As it has grown in size and importance, various aspects of the field have been studied from a historical point of view. Because no comprehensive study of the evolution of direct mail advertising exists, this thesis traces its development--principally by the use of secondary sources.

Direct mail advertising primarily promotes the sale of products and/or services of a single advertiser, who distributes by mail identically reproduced sales messages to a preselected audience--the choice of which can be controlled and identified by the advertiser. Principal developments have revolved around 1) format, 2) technology, 3) distribution, 4) the industry itself, and 5) uses by entrepreneurs.

Formats date back to Babylonian times when clay tablets, with queer cuneiform characters inscribed upon them, were used as a form of business letter. With the advent of printing, formats became diversified. By 1800 such formats as the handbill, announcement, pamphlet, and price list had evolved; in the late 1800's the so-called business letter format came into prominence, and has constituted the basic format ever since. Deviations from this format, however, are so numerous that a specialized jargon is used to identify them. . .such as brochure, mailing card, self-mailer, die-cut action piece, and broadside.

With the invention of printing, mechanical methods of reproduction slowly replaced former handwritten ones. Important technological inventions during the 1800's included the typewriter, Mimeograph machine, Multigraph machine, and Addressograph machine. With improvements upon these machines, and with the later invention of such labor saving devices as the automatic typewriter, postage machine, Multilith machine, inserting and stuffing machine, and recent electronic addressing equipment, speed and quality are far above their 19th century predecessors.

Distribution eventually became dependent mainly upon postal facilities--when, by the late 1800's, they became fast and economical enough for profitable use. In 1863 the economical third class mail category was inaugurated, and by the late 19th century railroads offered a fast

distribution system. Since then other improvements and innovations have occurred; in 1956 the Post Office distributed approximately 13 billion pieces of direct mail advertising.

Until the late 1800's, printers did direct mail advertising work. With the establishment of the Business Address Company in New York in 1876, however, a new industry of direct mail advertising "specialists" began. By the 1920's the number of firms devoting some or all of their facilities to direct mail advertising work had grown to an estimated 2,000; by the mid-1950's, about 35,000.

P. T. Barnum was one of the first to systematically use direct mail advertising techniques in America. The earliest systematic utilization in modern form, including postal facilities for distribution, was in the 1870's by mail order sellers and in the 1880's by J. H. Patterson of the National Cash Register Company. Since then expenditures and users have increased rapidly. By 1910 an estimated $100,000,000 was spent for direct mail advertising; in 1956, an estimated $1,419,000,000--second (next to newspapers) in total volume. Since any entrepreneur can use the mails for sales promotion, determining the number of users is impossible; some estimates, however, pass the million mark.

In short, direct mail advertising has grown, figuratively speaking, from an infant in the early 1900's to a veritable giant in the 1950's. As is often the case, development has been accompanied by growing pains. Some of the more vexing problems facing the medium today include illegal and deceptive practices, mailing list maintenance, attracting competent personnel, postal rates, and public relations. Although the medium is growing up, it still has room for improvement.

Microfilm $3.45; Xerox $11.80. 266 pages.

WHOLESALING USED AUTOMOBILES

(L. C. Card No. Mic 58-5449)

Robert Athan Lynn, Ph.D.
University of Illinois, 1958

This study presents an investigation of wholesale marketing channels for used automobiles. It consists of three main phases: determination of the approximate volume of wholesale sales of used automobiles, description and analysis of the wholesale marketing methods used, and examination of the changing market forces that have affected these methods.

The basic need for wholesaling of used automobiles by new-car dealers arises from differences in income level between consumers who buy new automobiles and those who buy used ones. Trade-ins on new cars constitute the principal original flow of automobiles into the used car market. These trade-ins, however, are not made in direct response to used car demand. They are by-products of the demand for new automobiles which is centered in higher income brackets than used car demand.

In the period from World War I to World War II new-car dealers often found retailing of used automobiles difficult. The pressure of used automobile inventories in the 1930s was an important factor in encouraging wholesale sales to used car dealers. During World War II wholesale sales of used automobiles were stimulated by regional differences in the availability of gasoline. The main movement was from the Eastern states to areas in the Midwest and Far West.

From 1946 to 1949 there was a substantial increase in used automobile wholesaling. High profits encouraged new-automobile dealers to wholesale used cars; high consumer demand encouraged expansion in the number of independent used car dealers. This increase in activity caused growth in wholesale automobile auctions which serve as central markets for dealers. Because the newer marketing methods were adapted to meeting the basic need for better adjustment of supply to demand, the post-war marketing pattern persisted despite less favorable conditions after 1949.

In 1956 new-car dealers sold about 2,300,000 used automobiles at wholesale; in 1957 they sold about 2,200,000. In both years wholesaling represented about 22 per cent of all used automobiles handled by new-car dealers. Individual dealers wholesale used cars to avoid the added financial outlay a full retail operation necessitates and to adjust their inventories to retail demand. There is a definite relationship between the new automobile sales volume of franchised dealers and their used car wholesaling percentage; larger dealers wholesale a higher percentage.

Independent used car dealers are the main buyers of used automobiles in the wholesale market, although new-car dealers also buy a few used automobiles in the wholesale market to improve their retail stocks. In 1954 used car dealers sold a total of about 4,000,000 used automobiles. They bought about 2,000,000 at wholesale. Differences in income levels and consumption patterns between sections of the country lead to inter-regional shipments of used automobiles. The most important movements are from the Great Lakes area to the West and Southeast.

Wholesale automobile auctions are specialized marketing institutions which facilitate wholesale transactions in the used automobile market. In early 1957 there were about 187 of these auctions in the United States. They sell about 1,000,000 automobiles a year, which is approximately half of all wholesale sales. The other sales are made direct from dealer to dealer.

Direct sales and sales through auctions have been effective marketing channels because they are adapted to the basic characteristics of used automobiles as products. Used automobiles have relatively high unit value and each one is unique. Auctions and direct purchases give buyers close control in making selections.

Used automobile wholesaling as a marketing practice developed spontaneously without unified planning. It grew in response to the changing market forces and the inherent market environment. It has continued because it serves the market needs well.

Microfilm $3.40; Xerox $11.60. 262 pages.

THE CONSERVATION PROGRAM OF THE RAILROAD COMMISSION AND THE STRUCTURE OF CRUDE OIL PRICES IN TEXAS

(L. C. Card No. Mic 58-5083)

Jack C. Rothwell, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Professor Charles L. Prather

The purpose of this study is to examine the nature and mechanics of crude oil conservation in general and the production control program of the Railroad Commission of Texas in particular, with emphasis upon the relation of that program to crude oil prices in Texas.

Chapter II, after a brief introductory chapter, presents a discussion of the physical and institutional factors which have been responsible for the development of conservation as a waste prevention measure and as a program to protect property rights. Also in this chapter, the dual basis upon which production control is implemented is discussed, that is, the concepts of the maximum efficient rate of production and of restriction of production to reasonable market demand.

In Chapter III, the techniques of and agencies concerned with the administration of crude oil conservation are analyzed. Included is a discussion of the Bureau of Mines market demand forecast procedure, an analysis of the mechanics of production control and proration as carried out by the Railroad Commission of Texas; a discussion of the nature of the program of the Interstate Oil Compact Commission; and a discussion of the Connally Hot Oil Act.

Chapter IV contains a historical analysis of crude oil conservation in Texas from 1899 through 1956.

In Chapter V, the relationship existing between the production control program of the Railroad Commission and crude oil prices is examined in the light of the technical, administrative, and historical analysis. Four significant questions are discussed: (1) Were waste or price considerations the stimulus responsible for the initiation of the production control program? (2) Has price maintenance or stabilization of prices ever been pursued as a policy of administrative action? (3) What effect has the production control program had on the level of crude oil prices over time? (4) How has the consumer fared while the petroleum industry has been under conservation regulation?

Concerning the first question, it is found that the general opinion prevailing among oil men, oil and gas lawyers, regulatory officials, academic economists, and others is that production control was initiated in response to both waste and price considerations, with perhaps a greater relative emphasis upon the price factor. It is noted, however, that prices in the early 1930's were at truly distress levels.

In regard to the second question, it is shown that at least in one instance (in the year 1939) price maintenance was pursued as a direct policy of administrative action by the Railroad Commission. It is pointed out, however, that the trend appears to be away from the consideration of price toward the establishment of physical waste as the principal criterion in the determination of production allowables. Nevertheless, it is noted that the Railroad Commission apparently retains a measure of policy flexibility concerning the role of price in production control administration.

As for the direct effects of production control on crude oil prices, it is found that a general strengthening of prices tends to result from the initiation of controls. Moreover, it is found that short run price fluctuations are reduced in both frequency and amplitude, and that the conservation program in the long run may be responsible for lower crude oil prices than those which would otherwise have prevailed, as costs are lowered and more oil is made available over a longer period of time.

Concerning the consumer and conservation, it is found that certain safeguards exist which tend to prevent the Railroad Commission from becoming overly producer oriented at the expense of the purchaser of petroleum products. Finally, on the basis of comparative price and income data, it is noted that both crude oil and gasoline prices have been kept at a reasonable level during the period in which the petroleum industry has been subject to conservation regulation.

In the final chapter it is concluded that the conservation program of the Railroad Commission is socially desirable on net balance, even though it has definite shortcomings. Microfilm $3.45; Xerox $11.80. 267 pages.

UNITED STATES GOVERNMENTAL INVESTMENT GUARANTEE PROGRAM FOR PRIVATE FOREIGN DIRECT INVESTMENTS, DEVELOPMENT AND APPLICATION 1946-1954

(L. C. Card No. Mic 58-5489)

Börje Osvald Saxberg, Ph.D.
University of Illinois, 1958

The climate for private foreign direct investments from the United States in the post-war period 1946-1954 was characterized by political, social, and economic obstacles emphasized in the minds of investors by unstable world conditions and the fear or threat of war. Governmental programming of economic development appeared as a new post-war deterrent to such investments; the capital flow between governmental and inter-governmental agencies was substituted for the traditional flow of capital between individuals.

With the introduction of the European recovery program, a system of governmental investment guarantees for direct investments from the United States was provided for in the Economic Cooperation Act of 1948, and renewed in subsequent foreign assistance legislation. Through the governmental assumption of the risks of inconvertibility and expropriation under the investment guarantee program, government officials and Congressmen expected the investment climate to improve sufficiently to promote United States direct investments abroad. The investigation reveals that investors utilized $48.6 million in guarantees during 1948-1954 ($33 million, allowing for reductions due to cancellations, conversion, or returns of the guaranteed investments) for investments in Western Europe; the available guarantee authority was $200 million. In comparison, United States post-war private foreign direct investments averaged some $1.2 billion annually.

The investigation reveals that in addition to a small utilization of the guarantees, large internationally well-known corporations rather than small business or firms

without foreign investment experience utilized the guarantee protection during 1948-1954. The investment guarantee program did not promote new direct investments from this country, nor did it increase significantly the volume of these investments. Private business opposed the guarantee measure partly because of the principle of governmental assumption of risks in private foreign investments, partly because of the administrative provisions governing the program. The indifference on the part of the administrative agency contributed to the failure of the program. The limitations in terms of eligible investments, foreign countries included, and post-war deterrents to private foreign direct investments made the investment guarantee protection inadequate in relation to the post-war foreign investment climate.

The guarantee program of the United States Government was a compromise between creditor policies of this government and debtor policies of foreign governments. It reflected the pattern of investments in response to profit opportunities, but it was also a concession to state planning of economic development. The governmental assumption of risks and the imposition of a governmental frame of reference on private investment decisions did not conform to the principles of the free enterprise economy of the United States.

The investigation suggests that investment guarantees were neither an effective nor an appropriate means for creating an investment climate conducive to increased direct investments from the United States. In a world characterized by international cooperation rather than international domination, the responsibility for such a climate was not within the power of the United States Government. If foreign governments are convinced of the desirability of private equity investments from this country, they must themselves create such conditions as will enable investors to judge confidently the opportunities and risks involved in investing at home and abroad.

The author suggests that though it might be impossible to find a real solution to the problem of the foreign investment climate, modern treaties of Friendship, Commerce, and Navigation are worthy of further consideration by the United States Government in promoting direct investments abroad. These treaties establish the policies under which investors may employ their funds abroad, and they provide a legal basis for the relations between foreign citizens and United States investors. The promotion of direct investments through the concluding of investment treaties appears to be more commensurate with the principles governing investment activities in a competitive economy than the encouragement through a governmental investment guarantee program.

Microfilm $5.20; Xerox $18.40. 405 pages.

THE BUDGETARY CONTROL OF FEDERAL EXPENDITURES

(L. C. Card No. Mic 58-5496)

Panas Simasathien, Ph.D.
University of Illinois, 1958

Purpose and Nature of the Study

The rate of spending of the Federal Government of the United States is currently at approximately 70 billion dollars a year. The need for effective control of such a gigantic outlay is evident.

The chief control over Federal expenditures lies in the budget process. Despite several recent improvements, the budgetary control of Federal expenditures is far from effective. There is still room for further improvements.

It is the purpose of this study to examine the control of Federal expenditures as exercised in the various phases of the Federal budget process, and, more important, to point out weak spots in present practice and to examine suggested improvements therefor.

The nature of this study is, in the main, that of library research, including study of the recent United States Government documents so that the completed study may reflect the latest legislation, budgetary practice, and possibilities for improvements thereof.

Findings

The budgetary control of Federal expenditures concerns three phases of the budget process - the preparation of the budget by the executive and the appropriation process in Congress, the execution of the budget, that is, the actual spending, and the establishment of executive accountability for budget execution.

It is evident in the study that each phase of the Federal budget process has inherent weaknesses. As the Government has grown in complexity and its spending increased many fold, these weaknesses become more pronounced, and the need for improvements more urgent.

In budget preparation, weaknesses are mainly the results of the complexity of the budget document. Improvements in this phase of the budget process can be made by simplifying the budget content so that the time required to prepare and approve the budget can be shortened. The weak spots of the legislative appropriation process lie in the piecemeal consideration of appropriation requests. Each House of Congress should consider appropriation bills in the light of their relation to the total appropriations, revenues, and basic legislation authorizing expenditures. More helps to Congressional Appropriations Committees, staffwise and informationwise, are also needed.

The control of Federal expenditures during the execution of the budget is the area where notable improvements have been made in the past decade. Accrual accounting and cost-based budgeting have been initiated to make expenditure control more effective. Controllability in this phase of the budget process may be increased further if appropriations are made to the executive agencies on the basis of annual accrued expenditures.

The weaknesses in the establishment of executive accountability lie in the anomalous position of the Comptroller General, the lack of adequate consideration and action on his audit reports, and the lack of comprehensive financial reports by the executive to Congress and the public.

Thus, it seems desirable that the independence of the Comptroller General be increased by limiting his duties to control functions only - i.e., audits, settlements of accounts, and investigations. His annual report and other audit reports should be constructively critical in regard to financial status and operating results of the executive agencies. They should be considered by a joint committee of Congress equivalent to the Committee on Public Accounts of the British Parliament so that Congress and the Appropriations Committees can benefit fully from the work and facilities of the General Accounting Office. And finally, comprehensive external reports should be developed by the executive branch showing the results of the activities of the Government as a whole and of its major component activities, its assets, and liabilities.

Microfilm $3.05; Xerox $10.40. 234 pages.

PERIODICITY AND THE PROVISION FOR FEDERAL INCOME TAX

(L. C. Card No. Mic 58-5516)

Paul Henry Walgenbach, Ph.D.
University of Illinois, 1958

Purely deductive approaches to the nature of the corporate Federal income tax provision have led writers and observers of the corporate scene to the various views that the tax is an expense, that it is a loss, or that it is a distribution of profits. Disputes concerning the nature of the tax might be of polemic value only, except for the fact that classifications of the tax by the use of various lines of deductive reasoning have been advanced as rationales for different methods of reporting the tax periodically. At the present time, a considerable division of opinion exists among accounting groups and regulatory bodies about whether the tax provision should be reported on an historical basis or be subjected to allocation techniques.

This study represents an inquiry into the theoretical and practical justification for allocation procedures with respect to the corporate Federal income tax provision. As a part of the theoretical approach, a review was made of the various views concerning the nature of the tax provision which have been presented in the past by the courts, economists, regulatory bodies, professional associations, and in financial and accounting publications. A second section of the writing is devoted to an examination of the divergences which exist between taxable income and business income, and an attempt was made to formulate allocation principles and procedures appropriate in dealing with such variations. These variations include divergences of timing, divergences arising from surplus entries, and divergences due to permanent inclusions and exclusions from either taxable or business income. An appraisal was then made of the limitations and deficiencies of such allocation procedures.

The remainder of the study involves an evaluation of the treatment of the tax provision in financial analysis and financial administration and a discussion of the implications of the tax allocation proposition for these areas. Use of tax data in rate determination and in reorganization proceedings is discussed here in addition to general financial analysis. An attempt was also made to evaluate the effects of allocation procedures upon income determination for a selected group of companies utilizing such procedures over a period of time, in terms of consistency and usefulness of the accounting data presented.

The general conclusions and recommendations derived from the study are as follows:

1) The tax provision is most appropriately regarded as a unique type of cost, whatever frame of reference is utilized.

2) The important features of the tax provision from an accounting standpoint are that it is ordinarily a recurring, periodic type of cost, and that it is the result of periodic transactions.

3) It is incongruous to apply allocation techniques to the transactions on an accrual accounting basis without applying the same techniques to the income tax provision derived from such transactions.

4) In view of the manner in which tax data and earnings figures are generally utilized in various types of financial analysis, it would appear that mere disclosure of unusual tax situations is not adequate to serve the needs of all readers of financial reports, and it is urged that tax allocation techniques compatible with accrual accounting, such as those set forth in this study, be universally applied.

5) It is believed that a combination of tax allocation in the financial statements and a separate reconciliation either between taxable and business income or between the tax provision and the tax liability are necessary in order to serve both the trained analyst and the lay reader of financial reports.

Microfilm $2.45; Xerox $8.60. 188 pages.

ECONOMICS, FINANCE

AN ANALYSIS OF DIRECT AND INDIRECT TAXATION: A RE-ORDERING OF SOME BASIC CONCEPTS IN TAX THEORY

(L. C. Card No. Mic 58-3938)

George Babilot, Ph.D.
University of Oregon, 1958

Adviser: C. Ward Macy

This dissertation attempts to re-order some basic concepts in tax analysis consistent with recent developments in price and employment theory. The study has two purposes: (1) to reconcile the conflicting views in tax incidence and effects theory, and (2) to establish guideposts useful for the construction of a general theory of taxation.

The logical deductive method is employed throughout. The treatment is concerned primarily with the problem of resource allocation and only incidentally with the problem of employment and income distribution. Efficient allocation means the Paretian optimum equilibrium

in exchange and production. Taxes are examined in terms of distortion toward or away from this optimum. By integrating and synthesizing recent contributions, the cases for direct and indirect taxes are examined and the major issues resolved by explicit adoption of the assumptions underlying each case. This method facilitated the derivation of nine propositions based upon three sets of assumptions: Assumptions A, initial ideal conditions and a constant supply of labor; Assumptions B, ideal initial conditions and the supply of labor variable; Assumptions C, initial conditions less than ideal and a constant supply of labor.

This approach made it possible to show that the conclusions of neoclassical theory concerning indirect taxation are valid given Assumptions A. Under Assumptions B, the neoclassical indictment against indirect levies cannot be verified through purely theoretical analysis. Both direct (other than flat-sum taxes) and indirect taxes will distort existing price ratios. Which of the two systems is least distorting is impossible to determine. Where less than ideal conditions prevail, Assumptions C, a case can be made for indirect taxes to restore optimum equilibrium in exchange and production.

The propositions and their assumptions are applied to two representative groups of taxes--excise and income. The incidence of an excise tax, under Assumptions A, is a function of individuals' preferences, their relative ownership of the factors of production, and government preferences as expressed in its expenditure policy. The benefits of an excise levy may partially offset the burdens; nevertheless, the tax impairs the efficiency of the economic system by altering the pre-tax optimum equilibrium. One case shows that an excise tax need not increase commodity prices, and the burden of the tax falls entirely upon factor incomes. Where labor is variable, the effect of an excise on its supply depends upon the complementarity of the taxed good with leisure. Under Assumptions C, an excise tax could conceivably be a corrective mechanism, but it might instead produce adverse employment and distributional effects.

Under Assumptions A, the income tax cannot be shifted. The burden is distributed proportionately among factor payments, relative prices remaining the same. Where labor is variable, under Assumptions B, the tax can be shifted, and the distribution of the burden depends upon the relative strength of the substitution and income effects. It is possible for the burden to be distributed in proportion to expenditures rather than income received. An income tax tends to reduce the supply of uncertainty bearing and the net rate of capital accumulation. These developments influence the ultimate burden of the tax, although the outcome is not easily determined. Where the pre-tax condition is less than ideal, an income tax could correct distortions in the work-leisure ratio and restore an ideal equilibrium.

Excise and income tax theory are found to be lagging behind other areas of economic analysis in substance and technique. It is suggested that a more general analysis than that afforded by the partial equilibrium approach be undertaken and that a more analytical concept of incidence be employed as a first step toward a revised tax theory.

Microfilm $2.75; Xerox $9.60. 211 pages.

THE ROLE OF CLEARING UNDER THE FEDERAL RESERVE SYSTEM

(L. C. Card No. Mic 58-3981)

Irving Oscar Linger, Ph.D.
The University of Texas, 1958

Supervisor: Professor E. E. Hale

The offsetting of monetary obligations as a means of settlement is one of the basic principles of banking. There has been little comprehensive treatment of this subject in recent years. At present, when we are pausing to reflect upon the general functioning of our monetary and financial arrangements, an analysis of offsetting or clearing may be considered opportune.

This dissertation was written to integrate the clearing process's recent history with its earlier development, and to discuss some of its more significant practical aspects. The mechanics of clearing are scrutinized in order to understand how they work, wherein lie their technical limitations, and how they are related to their institutional environment. Emphasis is upon the development of techniques under the auspices of the central banking system. One of the products of the study of these phenomena is an examination of the data pertaining to them and a consideration of their potential uses.

Evidence presented in the dissertation indicates a number of factors of some significance in evaluating the present status of clearing. For example, it is shown how new arrangements often have had their potential effectiveness modified by the need to adjust to established procedures in order to be acceptable. It is indicated, too, how technical improvements are subject to political pressures that affect their rate of introduction. Another factor brought out is the changing attitude toward the concept of "funds" and the significance of this for understanding the nature of money. Further, a review of the Federal Reserve par clearance controversy and its partial recurrence indicates the tenacity of past habits and the difficulty of modifying them to bring about greater efficiency.

A summary of the rapid development of automation in the area of banking emphasizes the importance of increased productivity in the service sector of the economy as efforts are made to combat inflation. Modern electronic machinery may enable the service sector to match the pace of the manufacturing sector in increasing efficiency to a greater extent than heretofore generally thought possible.

Finally, a study of the everflowing by-product of statistical data emanating from the clearing process, especially in connection with the Interdistrict Settlement Fund of the Federal Reserve System, provides a basis for analyzing interregional flows of funds. Emphasis is lent to the interregional inverse relationship between Treasury operations and clearings due to commercial and financial transactions, which leads to the acknowledgment of not one but a number of factors accounting for the phenomenon. Although there are a number of difficulties involved in making use of interregional clearing data, the conclusion is supported that there is merit in further investigation.

The clearing principle, though almost taken for granted, is as valid today as ever. Theoretically perfect clearing would involve complete offset of payments claims. This

would require greater centralization than appears feasible in the near future considering our diversified institutional arrangements. However, to the extent that the process of offset has been applied, a volume of settlements has been sustained that otherwise would have been impossible.

Microfilm $3.80; Xerox $12.80. 293 pages.

POLICIES AND OPERATIONS OF THE INTERNATIONAL MONETARY FUND: 1947-1956

(L. C. Card No. Mic 58-3998)

Leslie Clark Peacock, Ph.D.
The University of Texas, 1958

Supervisor: Professor Charles L. Prather

This study traces and examines the development of policy, as well as the operations, of the International Monetary Fund from 1947 through 1956. Chapter I, which contains a summary discussion of the international financial problems which had arisen prior to the establishment of the Fund, provides an introductory background for examination of the Fund's efforts to remedy many of the problems associated with the instability and disorder characteristic of the international financial scene during the 1930's and 1940's.

The Fund's Articles of Agreement are examined in Chapter II, and special attention is directed toward the ratification of the Articles of Agreement by the governments of the United States and the United Kingdom.

Chapter III contains an account of the Fund inauguration, with primary emphasis on the problems involved in the establishment of initial par values and the formulation of policies with respect to use of the Fund's resources during the postwar reconstruction period.

The development of the Fund's lending policy, supported by statistical data on exchange transactions, is presented in Chapter IV. Discussion of the evolution of more liberal lending policies is accompanied by a description of the changing circumstances which have permitted the adoption of a less stringent lending program.

The evolution of Fund policy with respect to exchange restrictions and multiple currency practices is traced in Chapter V.

The Fund's gold policy is examined in Chapter VI. This chapter deals primarily with the Fund's attitude toward premium gold prices and subsidies to gold producers.

In Chapter VII, which deals with par values and exchange rates, the Fund's efforts to achieve exchange stability and orderly cross rates are reviewed, and the success of its policies and operations are appraised.

The concluding chapter of this work evaluates the success of the International Monetary Fund in accomplishing its stated objectives, and concludes that the Fund has made important contributions toward their achievement.

Microfilm $3.20; Xerox $11.00. 247 pages.

ECONOMICS, THEORY

INTRODUCTION TO A CULTURAL THEORY OF MONEY

(L. C. Card No. Mic 58-3969)

William Crittenden Frederick, Ph.D.
The University of Texas, 1958

Supervisor: Professor Clarence E. Ayres

This is a dissertation upon the nature of money. It is an attempt to integrate anthropological concepts of culture with economic concepts of money so as to develop a greater understanding of the nature and role of money in human culture.

The study's central hypothesis is that money derives its meaning from the culture process. The culture process is conceived in terms of two interrelated, but analytically distinct, subprocesses -- the technological and the institutional; and the money system is seen to reflect the influence of these two functional elements of the culture stream.

The institutional significance of money is derived from the functional relationship obtaining among four components of culture: (1) the patterns of social stratification; (2) status-validation processes; (3) status symbols used in exchange; and (4) a prevailing ethical system rooted in reciprocal social relations.

In the evolution of culture, these four elements have conjoined to produce the exchange-fetish, which is a symbol of institutional power and authority utilized in reciprocal exchanges to validate status rank. In ancient times and in Western civilization from early modern times, technological development occurring in the presence of private property established a tendency for ritualistic exchange-fetishes to pass into market use where they have become identified as money. This evolutionary tendency was enhanced by the apparent functional compatibility of ceremonial exchanges and market exchange, both of which give effect to the community's patterns of status and reciprocity.

Under these circumstances, money symbolizes property and institutional authority. Moreover, in market exchange, money becomes a vehicle for the transfer of power from one transactor to another, and inasmuch as these transactions must comport with the dictates of reciprocal exchange, the moneyflows tend to validate the respective statuses of the parties to the exchange.

Monetary exchanges in advanced, complex societies differ from the general cultural configuration primarily in that money therin symbolizes and expresses not only the personal status relation but also the impersonal or institutionalized power relation that obtains between the component parts of the entire institutional framework.

The technological significance of money derives from its system of numerical notation and from the instrumental uses to which this system is subjected by the participants in the industrial process. Individuals, firms, and governmental agencies, by acting upon and through the system of numerical notation obtain shares of real income, allocate quantities of industrial resources to technologically defined goals, plan future activities, budget materials, and attempt to stabilize production and increase the national income.

Therefore, two basic but incompatible functions are combined in the money system. Ancient institutional practices call for money to be used as a symbol of power in a manner that is either technologically irrelevant or restrictive of industrial processes. Industrial processes call for a system of numerical notation wherein considerations of industrial expediency must take precedence over status-power configurations. The incidence of the machine process has tended to lessen the importance of money's institutional characteristics and has heightened the significance of its system of numerical notation.

Monetary theory has reflected these cultural characteristics of money. Particularly since 1930, monetary theory has showed increasing concern over the effect of moneyflows upon the technological operation of the industrial economy. Previously, its preoccupation with money's unstable value manifested an overweening concern with such institutional factors as the redistribution of money income, the confiscation of property, and the deterioration of capital investments.

This study contends that the functional incompatibility of money's technological and institutional elements is a basic factor in the emergence of contemporary monetary problems. Recognition of this fact in policy formulation is essential to the orderly resolution of monetary problems.

Microfilm $2.90; Xerox $10.00. 224 pages.

ALFRED MARSHALL AND ECONOMIC DEVELOPMENT

(L. C. Card No. Mic 58-5418)

James Arthur Gherity, Jr., Ph.D.
University of Illinois, 1958

In recent years, numerous writers have pointed to Classical economics as representing an approach to the theory of economic development superior to that of their successors. The only exceptions that are generally allowed are the Marxist writers and Joseph Schumpeter.

Closer examination shows, however, that the boldness and simplicity of the Classical model were achieved at the expense of generality. Instead of rigorously examining the causes of changes in the immediate determinants, the Classics were prone to simply introduce the concrete data of the age in which they lived as the premises of their model. The analytic tools used by the Classics in tracing the effects of changes in the immediate determinants suffer from the same lack of generality. Although adequate, in many cases, for the purpose of analyzing changes such as those postulated by the Classics, they are very frequently incapable of analyzing changes in any of the other immediate determinants. The lack of more adequate analytic tools led the Classics to dismiss or ignore some of the immediate determinants.

Finally, lack of attention to the role of time led the Classics to ignore the process of adjustment by which equilibria are achieved. The result is an undue emphasis on the equilibrium values which are of least practical importance, i.e., those which would be achieved only after decades of stationary conditions.

It is precisely in these areas where Classical economics were weakest that Marshall's chief contributions lie. In place of the introduction of concrete data into the system by way of assumption, he attempts to examine the forces representing potential sources of change in the immediate determinants and to indicate the various changes which would result under various alternative circumstances.

Because there are many possible combinations of changes in the immediate determinants, tools of analysis are required which are capable of tracing the effects of changes in any or all of them.

Among the tools of analysis adopted or developed by Marshall for this purpose, the schedules of supply and demand are the most important. They represent the focal point of all changes in the immediate determinants since all of these changes can be expressed in terms of their effect on the supply or demand for goods, services, or factors of production. Subsidiary tools provide the connecting links between all supply and demand schedules and thus permit the tracing of the indirect effects of change.

Marshall's treatment of the time dimension, although imperfect as an analysis of the process of adjustment, points up a number of things overlooked by the Classical analysis. Most important of these is that the importance of the factors determining equilibrium prices and quantities varies according to the time elapsed since the original disequilibrium. Although he agrees that, if ceteris paribus conditions existed for a long enough period of time, the equilibrium stressed by the Classics would be achieved, he points out that the assumption of ceteris paribus conditions for such a prolonged period would do too much violence to reality for these equilibrium values to be of any practical interest or usefulness.

Microfilm $2.10; Xerox $7.40. 158 pages.

AN EVALUATION OF SOME GROWTH THEORIES IN LIGHT OF UNITED STATES ECONOMIC EXPERIENCE, 1946-57

(L. C. Card No. Mic 58-5354)

Anne Osborn Krueger, Ph.D.
The University of Wisconsin, 1958

Supervisor: James S. Earley

This thesis investigates the empirical relevance of the stagnation thesis, the Harrod-Domar model, and Fellner's growth requirements for explaining the path of American economic growth from 1947 to 1957.

The development of thought on economic growth is first considered, and then the growth hypotheses to be tested are closely examined. The long-run growth of the American economy and the over-all contours of the American economic experience since World War II are then presented. In this context, quarterly constant dollar estimates of Gross National Product and its components are derived.

In order to evaluate the models, new estimates of capital capacity and capital stock in the postwar period are derived. Following this, growth of aggregate demand and its main components (consumption, fixed investment, net foreign investment, government, and voluntary inventory investment) are estimated, and the degree of capital capacity utilization over the postwar years is quantified.

The relevance of the growth theories for explaining

economic growth is then considered. Investment and capacity utilization data are used for eight individual industries, all manufacturing, and for the economy as a whole to test the significance of capacity utilization as an investment determinant. While some positive correlation was found between the degree of capacity utilization and the rate of investment for individual industries, the results were somewhat inconclusive. For aggregate capacity utilization, no significant relationship could be found. The author's hypothesis is that capacity utilization is relevant as an investment determinant when it is extremely high or low, but that over a wide intermediate range other investment determinants (profitability, expectations, new products and techniques, and the like) largely outweigh the significance of capacity utilization as a factor affecting investment decisions.

It is concluded that there is little evidence in the postwar period to support the stagnation thesis contention that the private economy is chronically unable to maintain full employment-full capacity growth. Indeed, in both the 1949 and 1954 upswings, government fiscal policy was contractionary: it was the strength of the private sector which brought about both upturns. In 1953, the decline in government spending seems to have been a dominant factor in bringing about the downturn.

Likewise, the Harrod-Domar requirement that demand growth be equal to capacity growth is found to have little relevance in explaining either the downturns of 1948 and 1953 or the continuation of economic growth in 1951-52 and 1956, although failure of demand to grow more rapidly in 1956 and early 1957 is an important factor in explaining the 1957 turning point, if not its timing. The basic weakness of the Harrod-Domar model is found to lie in its inadequate treatment of the factors determining the behavior of consumption, investment and other demand components, especially the role of monetary and price factors.

The Fellner requirement that there be no diminishing returns to capital or labor likewise does not seem to have been met in 1956 and 1957. Indeed, there is strong evidence that diminishing returns to capital set in in 1956 and continued in 1957, and may be of importance in explaining the downturn.

For the period 1947 to 1955, the behavior of demand components was the dominant influence on the course of economic activity, and the supply (capacity) side of the Harrod-Domar equation seems to have had little relevance.

The study points up the need for improved statistics and further investigation of both the theoretical and empirical aspects of growth.

Microfilm $4.95; Xerox $16.80. 388 pages.

EDUCATION

EDUCATION, GENERAL

AN APPRAISAL OF SECONDARY SCHOOL CURRICULUM MATERIALS PUBLISHED BY THE OREGON STATE DEPARTMENT OF EDUCATION

(L. C. Card No. Mic 58-3939)

Willard B. Bear, Ed.D.
University of Oregon, 1958

Adviser: A. C. Hearn

Purpose Of The Study

The major purposes of the study were to determine how well the secondary school curriculum guides and handbooks published by the Oregon State Department of Education have satisfied the needs of teachers and administrators and to obtain other evidence that might be useful in efforts to improve future publications.

Important facets of the study pertained to (a) methods used in preparing the publications, (b) the plan for distributing them, (c) teachers' and administrators' evaluations of publications in current use, (d) methods used to acquaint teachers with new materials as they are produced, (e) the purposes for which the materials are used, (f) the adequacy of the materials in terms of criteria drawn from the educational literature, (g) the organization and treatment of handbook contents, and (h) the kinds of instructional aids desired by teachers.

Methods Used In Gathering The Data

Appraisals of the publications and suggestions for improvement by teachers and administrators were obtained by the use of questionnaires and interviews. One or more questionnaires were distributed to each of 790 classroom teachers, 296 secondary school principals, and 36 county school superintendents. The percentages of completed questionnaires returned were 73 percent by the teachers, 94 percent by the county school superintendents, and 93 percent by the principals. Forty-one interviews were conducted with classroom teachers in 14 additional schools as a means of verifying the questionnaire results and of gaining deeper insights into problems associated with teachers' uses of the publications and the kinds of instructional aids that they desire and need.

Various printed sources were reviewed in obtaining data that were used in developing criteria by which to evaluate the publications. Provisions of Oregon Law and State Board of Education regulations were studied to see what characteristics are required in the state publications. All major curriculum bulletins published by the Oregon State Department of Education since 1900 were examined in order to note major changes that have occurred in the nature and purpose of these materials. All major textbooks in education pertaining to curriculum administration and supervision published since 1945 were scanned and references to recommended production procedures and opinions concerning desirable state curriculum materials were noted.

Summary Of Results

Among the more significant findings of the study were these:

1. The publications are poorly distributed among Oregon secondary school classrooms. For example, it was found that only 65 percent of the teachers had copies of the subject-area handbooks. Handbooks devoted to general topics, such as alcohol education and conservation education, were even less well distributed.

2. Administrators are generally better acquainted with the materials than are their teachers. All except two of 213 public high school principals had copies of the Guide to Secondary Education in Oregon as compared to 401 of 578 classroom teachers who had copies.

3. The plan whereby the publications are distributed through the offices of the county school superintendents was considered to be satisfactory by most public secondary school administrators.

4. The method used in supplying nonpublic high schools with the publications has not been satisfactory as evidenced by the fact that 46 percent of the principals of these schools suggested some different plan.

5. The weakest link in the plan for getting the materials into the hands of teachers is at the local level where principals have failed to call their teachers' attention to them.

6. The factors of school size and preparation of teachers have little bearing upon the use made of the publications by teachers.

7. There is a direct relationship of recency of publication to the extent to which subject-area handbooks were reported to be known to teachers. Eighty-one percent of the social studies teachers had copies of the Social Studies Handbook, which was published in 1955, while only 38 percent of the science teachers had copies of their handbook, which was published in 1949.

8. The secondary school curriculum bulletins published by the Oregon State Department of Education are in close agreement with criteria suggested by curriculum authorities and are in accord with national trends in most respects.

9. Teachers want general suggestions on what to teach as opposed to detailed suggestions, the former being preferred by a ratio of about six to three and one-half.

10. All the major sections of content contained in the subject-area handbooks are being used by a sufficient number of teachers to justify their inclusion in future editions.

11. Subject-area handbooks are used by teachers for two principal purposes--as guides to the development of their own courses of instruction, and as sources of ideas for teaching. Teachers are less interested in philosophy of their subject areas and suggested objectives.

12. Teachers of all subject areas value essentially the same kinds of handbook information.

13. All the secondary curriculum materials published by the Oregon State Department of Education are valued quite highly by the teachers and administrators who are familiar with them. A major weakness lies in the fact that adequate steps have not been taken to acquaint teachers with the materials.

Microfilm $2.35; Xerox $8.20. 179 pages.

FACTORS RELATED TO CHILDREN'S EXPRESSED COLOR PREFERENCES AT SELECTED GRADE LEVELS

(Publication No. 20,817)

Richard Edward Collier, Ed.D.
Syracuse University, 1957

Supervisor: C. W. Hunnicutt

Purpose

This study was designed to determine answers to these two major questions:

1. What are children's expressed color preferences at selected grade levels?
2. What are some factors related to these expressed color preferences?

Method

An instrument was constructed to measure children's expressed color preferences. The 8 colors--red, orange, yellow, green, blue, violet, gray, and white--were selected by a jury of art educators. The colors appeared in 4 geometric forms: abstract, circle, pyramid, and cube. There were 130 paired-comparison items for the five sub-tests. Part I consisted of abstract color; Part II consisted of variation in value of abstract color; and Parts III, IV, and V replicated the same color comparisons as Part I, but employed the forms of circle, pyramid, and cube, respectively. Plates were made and commercially photographed using 35mm. Kodachrome film. Space error for sidedness was controlled, and the order of presentation was randomized. A high degree of consistency resulted in a test, re-test situation.

Sources of Data

The final results were based upon the expressed color preferences of 591 children randomly selected from the first, third, fifth, and seventh grade levels, from two city, two suburban, and two central schools within a sixty-mile radius of Syracuse, New York. Each child supplied his name, sex, and age; each child's I.Q. and father's occupation were obtained from school records. The testing was completed during April and May.

Results of the Study

1. The final descending order of preference for the 8 colors based upon the total population was yellow, orange, red, blue, violet, white, green, and gray.
2. The "warm" colors of red, yellow, and orange were always ranked in the first three positions, regardless of age, sex, intelligence, or socio-economic status.
3. Yellow was always ranked first and gray last, regardless of age, sex, intelligence, socio-economic status, geographic location, or the form in which the color appeared.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

4. Intelligence, socio-economic status, geographic location, and the form in which the color appeared had no significant effect on the preferential order of these 8 colors.

5. Children ranked tint, hue, and shade, in that order for red, green, blue, and violet. The shades for each of the six spectral colors were ranked last.

Conclusions

1. Yellow was most preferred and gray least preferred at all grade levels regardless of sex, intelligence, socio-economic status, geographic location, or the form in which the color appeared.

2. With increased age, children exhibited a tendency to conform more to a single pattern of color preference. However, the pattern at each grade level was very similar.

3. There were slight differences in the color preferences of boys and girls. More boys than girls always ranked green higher; more girls than boys tended to rank white higher. More boys than girls preferred the shades of colors; more girls than boys preferred the tints of colors. Shades of colors were least preferred by both sexes.

4. Intelligence had no significant effect upon the preferential order of the 8 colors in this study. The rank correlations between children with high and with low intelligence for each of the 4 color forms were significant at the .001 level of confidence.

5. Socio-economic status had no significant effect upon the preferential order of the 8 colors in this study. The rank correlations between children with upper and with lower socio-economic status for each of the 4 color forms were significant at the .001 level of confidence.

6. The geographic location represented by the children in this study had no significant effect upon the preferential order of the 8 colors. These rank correlations for each of the 4 color forms were significant at the .001 level of confidence.

7. The form in which the color appeared in this study had no significant effect upon the preferential order of the 8 colors by the total population. The rank correlations for each of the 4 color forms were significant at the .001 level of confidence.

Microfilm $2.35; Xerox $8.20. 179 pages. Mic 58-5225.

SCHOLASTIC SUCCESS OF STUDENTS CHANGING SCHOOL OR COLLEGE WITHIN THE UNIVERSITY OF CONNECTICUT

(L. C. Card No. Mic 58-3910)

Gladys M. Engelbrecht, Ph.D.
The University of Connecticut, 1958

Statement of the Problem

The major problems of the study concerned the prediction of scholastic success for students effecting a within-university change of school or college; the differentiation of changed and non-changed students on scholastic aptitude and achievement; and the scope of within-university change of school or college as indicated through sampling of universities in the United States and at the University of Connecticut.

Procedure

Data on the nature and extent of within-university change of school or college were secured by a questionnaire survey of 73 universities and colleges in the United States. Data for the University of Connecticut were based upon freshman entrants of September 1950, 1951, and 1952.

T-tests of the mean differences between the changed and non-changed students were made to compare their scholastic aptitude and achievement as measured by the following variables: high school percentile rank, Ohio State University Psychological Examination, American Council on Education Psychological Examination (quantitative, linguistic, and total scores), Cooperative English Tests on Mechanics of Expression and Reading Comprehension, University of Connecticut Mathematics Placement Examination, I, and first semester quality point ratio.

A point biserial method of correlation, corrected for coarse grouping, was used to ascertain the predictive value of the above-mentioned measures, the cumulative quality point ratio prior to change and the quality point ratio earned during the first semester after change. The criteria of graduation-non-graduation and passing-non-passing on the marking continuum at termination of enrollment were used.

Results

For the three entering classes at the University of Connecticut, 955 of 4,404 students (21.7 percent) changed college or school. This finding is similar to the estimated proportion of students effecting such changes in other state universities and state colleges as determined by the questionnaire survey. Disregarding the School of Education, 30.2 percent of the changes occurred after one semester; 26.0 percent after the second semester; and 92.3 percent by the end of the fourth semester. Students changing from the College of Arts and Sciences graduated at a 29.5 percent higher rate, whereas those changing into this college graduated at a 11.0 percent higher rate, than the non-changed students.

Significant mean differences on measures of scholastic aptitude and achievement were found to favor, in general, students who changed school or college.

For all students changing school or college, the first semester quality point ratio correlated .33 with graduation and .56 with terminal passing marks; the cumulative quality point ratio prior to change correlated .40 with graduation and .62 with terminal passing marks; and the first semester after change quality point ratio correlated .47 with graduation and .65 with terminal passing marks.

Conclusions

1. More than one-fifth of the entering freshman entrants at the University of Connecticut change school or college during their undergraduate programs. Approximately one half of such changes occur by the end of the second semester, whereas nearly all occur by the end of the fourth semester.
2. The School of Engineering loses a large proportion of its students by change whereas the School of Business Administration gains a large proportion of changed students.
3. Changed students, on the whole, graduate at a higher rate, percentagewise, than do non-changed students.
4. None of the considered measures of scholastic aptitude and achievement consistently differentiates the changed and non-changed students.
5. Of the eleven predictors considered, the three quality point ratios correlated most substantially and consistently with graduation and terminal passing marks.

Microfilm $3.20; Xerox $11.00. 248 pages.

FACTORS INFLUENCING CRAFTS PRACTICES IN JUNIOR HIGH SCHOOL ART AND INDUSTRIAL ARTS PROGRAMS

(L. C. Card No. Mic 58-3912)

John Henry Fitzgerald, Ph.D.
The University of Connecticut, 1958

Statement of the Problem

This study was designed to discover the scope and status of the crafts taught in junior high school art and industrial arts departments in Massachusetts, Connecticut, and New Jersey; to determine existing curricular and organizational patterns; and, to obtain recommendations for improving crafts programs and interdepartmental relationships concerning them.

Method

Data for the study was secured through a survey of 181 selected junior high schools in Massachusetts (74), Connecticut (39) and New Jersey (68), by means of questionnaires and opinionnaires mailed to educators. Questionnaires completed by 224 teachers provided factual data on art or industrial arts programs wherein crafts were taught. Art and industrial arts teachers also completed opinionnaires, as did art and industrial arts supervisors, junior high school principals and school superintendents. Of the educators surveyed, 62 per cent in Massachusetts, 56 per cent in Connecticut and 63 per cent in New Jersey submitted data--a total of 533 respondents.

Results

Data as compiled identify specific crafts, tools, equipment, and aspects of curricula and organization in the schools and states surveyed. Also identified are crafts, tools and equipment which in the opinions of the educators surveyed, are most important to effective crafts programs. The extent of agreement of respondents on some controversial aspects of the crafts are indicated, as are their recommendations for the resolution of interdepartmental differences and the improvement of crafts teaching.

Conclusions

An analysis and interpretation of the data led to the following conclusions:

Few crafts are the particular province of either art or industrial arts departments. Specific crafts are assigned to one department or another on the basis of such factors as space, personnel, time, equipment, budget, etc. according to the local situation. Meagre amounts of tools and equipment are limiting the scope of the crafts.

Better integration of the personnel and facilities of art and industrial arts departments can be effected by proximal location of these facilities. Even in new buildings, however, there is little planning for such location.

Efforts to coordinate or merge art and industrial arts departments through joint supervision or through the interchangeable use of their respective facilities are not yet common.

Evidence of little cooperative planning and minor participation in curriculum planning and policy making by art and industrial arts teachers gives credence to the likelihood of indifference or lack of understanding on the part of supervisors and administrators concerning art and industrial arts planning.

In rating art and industrial arts programs and equipment, there is a wide difference in the individual perceptions of the raters as to what constitutes quality. Teachers seem unable to convince their supervisors and administrators of the true status of these programs and items of equipment.

If, as the majority of the respondents' opinions suggest, the specific aims and objectives of art and industrial arts are similar, there is added reason for cooperative planning for the crafts.

The minority of educators who feel that variance in educational philosophy exists between art and industrial arts and who believe that crafts teaching should be exclusive with one department or the other, poses a threat to interdepartmental harmony and the future of the crafts.

Art and industrial arts teachers are more aware of, and less inclined to minimize, the inherent interdepartmental frictions concerning the crafts than are their administrators. Educationally undesirable frictions, if not alleviated, may cause a serious breach between art and industrial arts educators.

Microfilm $3.40; Xerox $11.60. 262 pages.

AN ANALYSIS OF THE RELATION BETWEEN PITCH DISCRIMINATION AND PHONIC SENSITIVITY IN FIRST GRADE CHILDREN

(L. C. Card No. Mic 58-3916)

Harriet Lillian Gesler, Ph.D.
The University of Connecticut, 1958

Statement of the problem. This study was designed to examine the relationship between pitch discrimination and phonic sensitivity in first grade children.

Method. Data for the study were secured through the testing of all the children enrolled in the first grade at East Haven, Connecticut during the months of April and May, 1957.

An original group test was designed to measure phonic sensitivity. It included enough items to measure the entire spectrum of consonant and vowel sounds. This test was tried in a pilot study, the results of which furnished data for test validation. A second pilot study was conducted in order to determine if the revised Seashore Pitch Test could be used successfully with first grade children. The results of this trial indicated that the Seashore Pitch Test was not totally adaptable to subjects as immature as these. Consequently, an original pitch test was developed and then tried with a pilot study group. The results of this trial furnished data for test validation.

Results. The data as analyzed indicate the degree of relationship between pitch discrimination and phonic sensitivity. The influence of mental maturity on pitch discrimination as well as the influence of mental maturity on phonic sensitivity was analyzed. The data were examined in order to determine if any significant differences existed between the test performance of boys and that of girls in both areas. The data were further analyzed for differences in the performances of the extreme groups of the pitch test distribution.

Conclusions. The analysis of the data led to the following conclusions:

The correlation coefficients for boys expressing the relationship between pitch discrimination and consonant perception, pitch and consonant blend perception, and pitch and vowel perception are significant. For girls, only the correlation coefficient expressing the relationship between pitch and consonant perception is significant. Coefficients expressing the relationship between the pitch test scores and the total phonics test scores are small, positive, and significant with no real difference between the performance of boys and that of girls.

Correlation coefficients between pitch and mental age show a small, positive, and significant relationship. There is no significant difference between the correlation coefficient for boys and that for girls.

Correlation coefficients between phonics test scores and mental age are high--indicating a strong, positive relationship. The difference between the coefficient for boys and that for girls is not significant.

The partial coefficient between pitch and phonics, holding mental age constant, is significant for the total group; the partial correlation coefficients are not significant for either boys or girls.

An analysis of the upper and lower twenty-seven percent groups of the pitch test distribution shows no mean differences between boys and girls in any of the variables within the upper and lower group. There is, however, a significant mean score difference between the upper and lower group in mental age.

The correlation coefficient showing the relationship between pitch and phonics for the upper group is significant, while that for the lower group is not.

The correlation coefficients expressing relationship between pitch and mental age are not significant for either the upper or lower pitch test group.

Relationship between phonics and mental age is high for both groups, with no significant difference between the coefficients of correlation.

With mental age held constant, the partial correlation coefficient showing the relationship between pitch and phonics for the upper group is weakened but remains significant. Holding mental age constant invokes no change in the non-significance of the relationship between pitch and phonics for the lower pitch test group.

Microfilm $2.00; Xerox $6.00. 122 pages.

INTRODUCING AVIATION EDUCATION IN ILLINOIS SECONDARY SCHOOLS

(L. C. Card No. Mic 58-5424)

Paul Byron Hale, Ed.D.
University of Illinois, 1958

The purposes of this study were to identify and to deal in theory with problems which may arise and interfere with introducing aviation education in Illinois secondary schools. The study was conducted within the organizational structure of the Illinois Curriculum Program--Aviation Education Project to serve certain functions of the Project. These functions were (1) to inform the schools about the series of aviation education resource units developed by the Project, namely, the Our World of Flight Series; (2) to encourage teachers to use the resource units in planning and conducting classroom activities; and (3) to assist teachers in their use of these materials of instruction.

Two chapters set forth the background for the study. Chapter 1 describes two contrasting conceptions of the nature of aviation education and discusses the significance of aviation education in terms of the functions of the school, the social effects of invention, and the military security of the nation. Chapter 2 sketches the purposes and the accomplishments of the Illinois Curriculum Program--Aviation Education Project to date, lists the objectives of aviation education for the Project, and summarizes the contents of the five resource units in the Our World of Flight Series.

By means of interviews with selected school administrators, teachers, and aviation educators, correspondence with aviation educators, and library research the writer identified approximately one hundred problems which may handicap Project efforts to promote aviation education. Subjects who cooperated in the problem identification phase of the study were selected because of their direct involvement in the Illinois Curriculum Program--Aviation Education Project or other major aviation education activities.

The problems were organized according to two main topics: namely, Problems of Psychological Resistance to Involvement; and Problems of Execution. The problems were further organized according to topical subheadings: namely, Confusion over Purposes; Misgivings about Justification; Traditional Subject Matter Interests and Objectives; Insecurity in Dealing with Aviation Topics; Uncertain Backing from Administrator or Supervisor; Lack of Instructional Materials and Facilities; Lack of Evidence of Community Interest and Approval; Overcrowded School Program; and Securing Financial Support; Communicating Ideas, Information, and Enthusiasm; Providing Aviation Education Training Opportunities; Providing for Supervisory Guidance; Coordinating Aviation Education Activities; and Providing for Follow-up Activities.

The writer dealt in theory with the problems by (1) examining them in the light of the purposes of aviation education for the Project and the significance of aviation education for curriculum improvement; (2) by developing proposals for organizing aviation education resources in Illinois; (3) by developing proposals for informing school administrators, teachers, and school patrons about the Illinois Curriculum Program--Aviation Education Project; and (4) by developing proposals for encouraging and assisting schools in their use of the aviation education resource materials. The principal sources of possible solutions for the problems were the literature of aviation education and educational literature.

Microfilm $3.25; Xerox $11.00. 249 pages.

FACTORS OF RELIGION AND SOCIAL CLASS IN THE SUPPORT OF PUBLIC SCHOOLS

(L. C. Card No. Mic 58-3922)

John Vincent Hulser, Ph.D.
The University of Connecticut, 1958

The purpose of this study was to learn whether or not religious affiliation and social class status influence support of the public schools. The study was carried out in Rutland, Vermont. Rutland has a population about evenly divided between Catholics and Protestants. It also has an equally divided school system, half of the students going to parochial schools and the other half to public schools.

An interview-questionnaire was used. One-hundred and ten people were chosen to answer the questionnaire. Ten people, five Catholics and five Protestants, were chosen from each city ward. These people were chosen on the basis of social class. The criteria set forth by Hollingshead in his "Elmtown's Youth" were used for the selection of the five social classes. Three people, familiar with both Rutland and the study helped with the choice of respondents.

The questionnaire contained forty-nine questions. These questions were designed to seek answers that would reveal:

(1) The respondent's social class.

(2) The respondent's evaluation of, and interest in, the public schools.

(3) The respondent's expressed feelings toward tax support of the public schools.

A one-hundred per-cent response was secured for the interview-questionnaire, although not for every question.

The responses to the questions were then tabulated according to the religion and social class of the respondents. The responses were next analyzed by totals and percentages. Those answers that seemed to differ significantly for social class and/or religious groupings were then treated statistically by means of chi-square. Chi-square analysis was used to compare the responses of the two upper social classes of both religious groups to the responses of the two lower social classes.

The findings of this study indicate that religion plays an important part in financial support of the public schools. It was found that Catholics indicated little desire to increase the school tax, holding that the school budget was ample. Protestants indicated a desire to increase the school tax holding that the budget was not ample. Social class did not statistically reveal significant results relative to financial support.

It was also found that the upper social classes of both religious groups gave responses that indicated they knew significantly more about the curriculum and the problems of the public schools than did the lower social classes. Although Catholic parents and their children attended parochial schools in significantly large numbers, no conclusions were reached in this study to interest support of public schools by religion.

This study pointed out the need for at least four other studies. These were:

(1) Utilization of the same social class criteria but use of other factors such as age in testing for significant differences.

(2) Selection for study of communities which have parochial schools that:

(a) are undergoing increases or decreases in population.

(b) have more than one parochial system.

(3) Selection of respondents by specific religion within the Protestant group.

(4) A similar study in Rutland, done after educational program aimed at the dissident groups has been carried out.

Microfilm $2.15; Xerox $7.60. 162 pages.

A STUDY OF ELEMENTARY TEACHERS' ATTITUDES TOWARD CURRICULAR PATTERNS, METHODS, AND MATERIALS IN GEOGRAPHY AND HISTORY IN THE STATE OF LOUISIANA

(L. C. Card No. Mic 58-5581)

Janet Lucar, Ed.D.
University of Houston, 1958

The purpose of this study is to determine the reaction of selected Louisiana elementary teachers to the curricular patterns in geography and history, to discover the methods these teachers use in presenting geography and

history, and to survey materials they use in teaching geography and history.

Two different instruments were used to obtain information for this study. The first instrument was an inquiry sheet used as a preliminary device to help determine what should be placed in the second instrument, the questionnaire. The questionnaire furnished information concerning books, subject matter, teachers' attitudes toward curricular patterns, activities, supplementary materials, and methods of presentation used in teaching geography and history. These instruments were sent to one teacher in each elementary school in the five parishes used in the study, which were: Caddo, Calcasieu, Catahoula, East Baton Rouge, and Orleans Parishes. Each one of the specific areas listed on the questionnaire: books, curricular patterns, curricular activities, supplementary materials, and methods of presentation is discussed in this study. This study suggested areas for potential reforms that might be made by Louisiana in the geography and history program in elementary schools, and should provide a basis for future curricular revision and the preparation of curriculum guides and materials.

Conclusions

This study has revealed that

1. The instructional program in the elementary school is based chiefly on textbook-centered activities.
2. There is no evidence of any great discontent with the social studies program in general or the subject matter included in the program.
3. It is evident from this study that there is a lack of uniformity in the curricular pattern in the social studies program.
4. Supplementary materials such as films, filmstrips, records, and maps are used only about 30 per cent of the time.

Recommendations

1. Provision should be made to expand the elementary social studies program to include other activities and experiences besides those gained through textbooks.
2. Teachers who are dissatisfied with the social studies textbooks should carefully examine other adoptions and select those more nearly suited to their needs.
3. A more uniform social studies program could be put into effect if the state would produce a curriculum guide for social studies.
4. Special supervisors at the state and parish level should adopt some means of suggesting to teachers how supplementary materials could be used to enrich the social studies program.

Microfilm $3.00; Xerox $10.20. 230 pages.

A STUDY OF OREGON'S PUBLIC SCHOOL TRANSPORTATION PROGRAM

(L. C. Card No. Mic 58-3951)

Leonard B. Mayfield, Ed.D.
University of Oregon, 1958

Adviser: Miles C. Romney

Oregon's system of public school transportation has developed during the past fifty years from a program which served relatively few children to one which now provides transportation at public expense for more than 40 percent of the school children of the state.

Under the Basic School Support Fund, Oregon provides to public school districts aid for transportation of pupils in the amount of "one cent per mile for twice the distance from the pupil's home to the school by the nearest traveled road" except in any county in which the latest school census shows an average of fewer than 2.5 children of school age per square mile. In these latter counties, the apportionment is two cents per mile. No district may be reimbursed for more than 60 percent of its total transportation costs.

This present study of the operation of the foregoing law was undertaken in 1954 as a part of a larger study of the Basic School Support Fund made by the School of Education of the University of Oregon under contract with the State Board of Education. It was anticipated that the study would guide the legislature in appraising the need for change in the existing law. This is a report of the research and action phases of the study of transportation.

An analysis of the operation of the transportation section of the law indicated that:

1. While the law is based on the assumption that the sparsity of population results in an increase in the unit costs (pupil mile) of transportation, available data in Oregon do not indicate this to be so, at least not to the extent represented by the one- and two-cent differential.
2. Though the law is based on the assumption that the density of population in the districts is the same as the density of population in the counties in which they are located, this is an unjustified assumption.
3. In some respects and in some instances state reimbursement of local districts for transportation appears to constitute equalization in reverse. It is the districts in the wealthiest counties that are receiving the two-cents per pupil mile reimbursement.

Following the analysis of the data which showed the existence of inequities in the present distribution formula, a committee of school administrators and school board members was selected to discuss the means through which corrective legislation might be secured. After several meetings the committee agreed upon the support of legislation which would increase the equalization of the costs of transportation.

An endeavor was made prior to the opening of the legislative assembly to secure favorable support for the formula by various groups within the state. The State Board of Education referred the entire report of the study of the Basic School Support Fund to a 40-member citizens committee for study and reaction. The Citizens Committee voted almost unanimously to support one of the formulas for distributing transportation aid which the present writer and his colleagues had developed in the study here

reported. The State Board of Education, however, took no positive action on the Citizens Committee recommendations, voting only to submit the entire report together with the Citizens Committee's recommendations to the legislature for such action as it might care to take.

The legislature refused to take action upon any phase of the Basic School Support Fund formula, including transportation, until agreement was reached relative to the major distribution formula. Since no such agreement was achieved, the legislature adjourned without action on the transportation formula.

This study revealed that it was possible to determine the inequities and inadequacies in the current state aid for transportation program. It was possible to secure agreement upon corrective legislation as far as educational interests in the state were concerned, providing that no district experienced a reduction in the funds received from state sources. Those administrators in districts which had little or nothing to gain from the corrective legislation, however, did not support the program when it was presented to the legislature. It was also seen that the transportation aid program, always a minor part of the Basic School Support Fund, could not receive special consideration. Any action taken upon this phase of the total program was dependent upon and subordinate to action taken upon the major distribution formula.

Microfilm $4.05; Xerox $13.80. 316 pages.

A COMPARATIVE STUDY OF SELECTED ASPECTS OF VOCATIONAL GUIDANCE IN FRANCE AND THE UNITED STATES

(L. C. Card No. Mic 58-3927)

Ralph Frank Nestico, Ph.D.
The University of Connecticut, 1958

Statement of the Problem

The purpose of this study was to compare selected aspects of vocational guidance in France and in the United States.

Procedure and Method

In 1956, the author was the recipient of a Fullbright Scholarship for the specific purpose of making a study of vocational guidance practices and techniques in France. Materials for this study were obtained from the Ministry of National Education, the National Institute of Vocational Guidance in Paris, visits and conferences at vocational guidance centers, the Vocational Guidance Service of the Seine Department, Le Musée Pédagogique, Le Centre National de Documentation Pédagogique, Le Centre International d'Etudes Pédagogiques de Sèvres, and a series of lectures at the Sorbonne and the International Center in Nice.

Summary and Implications

A comparison of selected aspects of vocational guidance in France and the United States revealed the following:

1. The basic philosophy which governs vocational guidance in France is the desire for the best possible use of human resources for the national need, whereas, in the United States vocational guidance is conceived as a service for career development and aiding individual growth.
2. The dual system of education in France has resulted in the provision for vocational guidance primarily to the group of students who terminate their formal education with the elementary school, whereas, the unified system of education in the United States includes vocational guidance for all as an integral part of the educational process.
3. In France vocational guidance developed as a service separate from the school, whereas, in the United States guidance services are a part of or closely related to the publicly supported educational system.
4. The authoritarian philosophy of the French has resulted in a federally-financed, centralized and unified system of vocational guidance under the control of the Technical Section of the Ministry of National Education, whereas, the democratic philosophy in the United States has preserved the ideal that institutional control should be located with the individuals served, so that vocational guidance is a state and local responsibility.
5. In France the State decides where the individual is to serve, whereas in the United States the individual decides for himself on his life's work.
6. Tests of intelligence, aptitudes, and interests are given much more weight in France than in the United States.
7. France has established uniform standards of training and certification for counselors, whereas, in the United States there is a wide variation with respect to the professional background and preparation of counselors.
8. Apprenticeship and placement are important phases of the vocational guidance program in France, whereas, in the United States the effort to provide further training for school leavers and placement in jobs has been limited.
9. A thorough medical examination is required of all who receive vocational guidance in France, whereas, this is not a common practice in the United States.

An assumption fundamental to this study was that there may be some implications for American vocational guidance in the practices and techniques adopted in France. The implications reached from this study raise certain issues which may be entertained for further study with a view for their value for the United States.

1. The possibility of experimenting with federally-supported vocational guidance centers in key cities in the United States to supplement the available services and help solve the problem of inequities which now exist.
2. A re-examination of the training programs for counselors with a view to establishing a uniform set of standards through some central governmental agency.
3. A review of the provisions made for school leavers with special consideration given to re-establishing an apprenticeship program and providing placement and a terminal medical examination in order to effect a proper transition from school to work.

Microfilm $2.60; Xerox $9.00. 198 pages.

RELATIONSHIPS BETWEEN OUT-OF-SCHOOL ACTIVITIES OF TEACHERS AND THEIR ATTITUDES TOWARD PUPIL-TEACHER RELATIONS

(L. C. Card No. Mic 58-5212)

W. James Popham, Ed.D.
Indiana University, 1958

Chairman: Howard T. Batchelder

This study was designed to explore the relationships between teachers' out-of-school activities and their professional performance. The index of professional performance utilized in the study was a teacher's attitude toward pupil-teacher relations.

Two variables were treated in the study: (1) teachers' attitudes toward pupil-teacher relations, and (2) teachers' out-of-school activities. Out-of-school activities included: professional activities, organization activities, sports activities, employment activities, daily living activities, entertainment activities, and hobby activities. These activities were treated in terms of frequency of participation in particular activities or groups of activities.

Two measuring instruments were utilized in the investigation. The first of these was a questionnaire designed to obtain information about the out-of-school activities of teachers. The second was the Minnesota Teacher Attitude Inventory (MTAI), an instrument empirically designed and validated to assess teachers' attitudes toward pupil-teacher relations.

The research sample used in the study consisted of 880 teachers who were 1954 graduates of the twenty-four Indiana institutions of higher learning with standard accreditation for teacher education. Only those graduates who were professionally employed by the public schools of Indiana during the 1956-57 academic year were selected as subjects.

During the Spring of 1957, copies of both research instruments were administered by mail to all subjects. Two separate follow-up mailings were employed for non-respondents. Of the original sample, 738 subjects, or 83.9 per cent, returned completed research materials.

Relationships between particular out-of-school activities of teachers and their attitudes toward pupil-teacher relations, as measured by the MTAI, were tested for significance by means of the chi square statistic.

Results

Certain out-of-school activities of teachers were significantly related to their attitudes toward pupil-teacher relations. These activities were: attendance at professional meetings, local educational organization meetings, and Parent-Teacher Association meetings; number of professional books and periodicals read; time spent viewing television, doing housework, as a spectator at school events, and in home visitations and parent conferences; participation in religious organizations, service organizations, professional organizations, and hobbies; and membership on educational committees.

Certain out-of-school activities of teachers were not significantly related to their attitudes toward pupil-teacher relations. These activities were: current enrollment in college courses for credit; out-of-school employment, amount of nightly sleep; time spent listening to the radio, preparing for teaching, and reading non-professional literature; participation in military-patriotic organizations, leisure organizations, youth groups, fraternal orders, relief-welfare organizations, team sports, individual sports, spectator sports, commercial entertainment, and non-commercial entertainment.

Conclusions

Interpretations of the findings of the study should be limited by the fact that only selected out-of-school activities were treated, and even more important, only one index of professional performance was utilized. The design of the study allowed for no determination of causal relationships.

Results of the study indicated that there were no significant relationships between the whole range of teachers' out-of-school activities and their attitudes toward pupil-teacher relations. Teachers' attitudes toward pupil-teacher relations were, however, significantly related to a considerable number of these out-of-school activities. Generally, these relationships took the form of a tendency for teachers who evidenced greater participation in activities to obtain higher scores on the MTAI, i.e., higher in terms of their likeliness to establish good rapport with pupils.

Teachers' participation in professional activities, e.g., attendance at P-TA meetings, membership on educational committees, reading professional literature, appeared to be most consistently related to teachers' attitudes toward pupil-teacher relations. Of the fourteen activities significantly related to MTAI scores, nine were of a professional nature. The remaining significant relationships between MTAI scores and non-professional activities were neither sufficiently numerous nor sufficiently systematic to warrant any general conclusions.

Microfilm $2.00; Xerox $5.60. 111 pages.

A HISTORY OF CALIFORNIA STATE POLYTECHNIC COLLEGE, THE FIRST FIFTY YEARS, 1901-1951

(L. C. Card No. Mic 58-3949)

Morris Eugene Smith, Ed.D.
University of Oregon, 1958

Adviser: A. C. Hearn

This study seeks to present a history of the California Polytechnic from 1901 to 1951.

Useful to the writer were certain materials available in the California State Polytechnic College Library: catalogues, bulletins, yearbooks, records, and publications of the institution; minutes of meetings of its board of trustees and reports issued by that body; letters and articles written by staff members, and two undocumented histories of the school - one appearing in book form in 1908, and the second, unpublished, covering the period from 1901 to 1932.

In the San Luis Obispo city and county libraries the writer had access to state statutes and budgets and to

local newspaper files. He examined minutes of State Board of Education meetings and various California Department of Education publications in the State Library and in the office of the State Superintendent of Public Instruction in Sacramento. Of particular value was information obtained through interviews with Miss Margaret Chase, on the Polytechnic staff from 1908 to 1945, and with John Perozzi, who served the institution from 1912 to 1958.

The dissertation is developed chronologically, opening with a chapter on the founding of the school and then tracing the growth of the institution under the administrations of each of its six directors or presidents. Topics treated include educational philosophy, curriculum, physical facilities, finances, personnel, and student activities as they developed under the various executives of the Polytechnic.

Although it suffered several setbacks brought on by economic conditions, the Polytechnic underwent gradual growth from 1901 to 1945. Its period of most rapid expansion was from 1945 to 1951. Through the decades the basic function of the institution continued to be the provision of practical, occupational training for agriculture and industry. The school made its most significant contribution by stressing learning by doing, by preparing its students for actual job situations.

In 1903, with Leroy Anderson as director, the Polytechnic opened as a three year vocational high school with classes in agriculture, mechanics, and household arts - the first public institution in California to offer courses in agriculture on the secondary level. Through the years, as requirements for semi-professional positions were raised, the staff of the institution gradually upgraded the school training program. In 1916 the faculty added a fourth year of work, and in 1927 the institution included a junior college division. In 1933 the Polytechnic became a three year college and in 1940 a four year college. It granted baccalaureate degrees for the first time in 1942. During the late 1940's graduate work in teacher-training was established at the institution.

In line with the Polytechnic emphasis on vocational training was its heavy stress from the mid-1920's on the project system, which permitted the student to earn while he learned.

By 1950 the original 280 acre campus had been expanded ten times in size, and additional branches, the Voorhis Unit (1938) and the Kellogg Unit (1949) - both in the Los Angeles area - extended the Polytechnic philosophy and system of education.

For decades enrollments increased slowly, not exceeding 200 until the 1920's, and reaching 780 by 1940. After 1945 the number of students rose sharply with 2900 in attendance by 1950.

By mid-century the California Polytechnic was a state college with divisions of Agriculture, Engineering, and Science and Humanities. It was expanding rapidly under the capable guidance of President Julian A. McPhee. Its future seemed assured.

Microfilm $3.80; Xerox $13.00. 299 pages.

AN ANALYSIS OF SCHOLASTIC ACHIEVEMENT OF TRANSFER STUDENTS FROM PURDUE EXTENSION CENTERS

(L. C. Card No. Mic 58-3199)

Donald Swank, Ph.D.
Purdue University, 1958

Major Professor: Elizabeth K. Wilson

This study was designed to compare the scholastic achievement of extension students who transfer to the campus with the scholastic achievement of matched campus students. The extension group was divided into two subgroups. One subgroup had taken one year in extension and the other subgroup had taken two years in extension. The extension students were matched with regular campus students on four matching variables--sex, semester classification, cumulative index over comparable periods, and the school in which they registered in the University. The study thus involved 251 matched pairs of students for a total of 502 students. Of the 251 extension students, 170 had completed one year in extension and 81 had completed two years in extension. Comparisons of the 170 matched pairs on the differences in scholastic achievement were made at the end of semester 4, the end of semester 6, and at graduation. Comparisons of the 81 matched pairs on the differences in scholastic achievement were made at the end of semester six and at graduation. All of the above comparisons were based on indexes of matched pairs in which data were available for both members.

Other comparisons were made on the following variables related to scholastic achievement: the proportional number of students in each group who graduated, the proportional number of students in each group who were on probation, the proportional number of semesters completed by students in each group, and the proportional number of students in each group who received honors at graduation.

Descriptions of the two groups were presented in respect to other variables such as rank in high school, deficiencies at the time of entry, placement scores, and the mean number of hours completed in extension or on the campus for the same period of time.

The following Hypotheses were tested:

Hypothesis 1. There is no difference between the scholastic achievement of extension students and the scholastic achievement of campus students.

Hypothesis 2. There is no difference between the proportional number of extension students graduated and the proportional number of campus students graduated.

Hypothesis 3. There is no difference between the proportional number of extension students who were on probation and the proportional number of campus students who were on probation.

Hypothesis 4. There is no difference between the proportional number of semesters completed by the extension students and the proportional number of semesters completed by the campus students.

Hypothesis 5. There is no difference between the proportional number of extension students who graduated with honors and the proportional number of campus students who graduated with honors.

Hypothesis 1 was tenable for both groups at the end of semester 6 and at graduation, but was rejected at the one per cent level at the end of the sophomore year.

Hypothesis 2 was tenable for the group of 81 matched pairs and rejected for the group of 170 matched pairs.

Hypothesis 3 was tenable for the group of 81 matched pairs and rejected for the group of 170 matched pairs.

Hypothesis 4 was tenable for both groups.

Hypothesis 5 was tenable. In performing this test both subgroups were combined.

The scholastic achievement of extension students who transfer to the campus after two years in an extension center is not significantly different from that of matched campus students. Extension students who register on campus after only one year at an extension center seem to require a period for adjustment. These students, however, by the time of graduation have achieved as well as the students with whom they were matched who have spent four years on campus.

Microfilm $2.00; Xerox $5.20. 103 pages.

A STUDY OF THE PURDUE UNIVERSITY ENGINEERING GRADUATE

(L. C. Card No. Mic 58-5502)

Edward Charles Thoma, Ed.D.
University of Illinois, 1958

This investigation is a descriptive study of the Purdue University engineering graduates with regard to their college experiences, job experiences, personal information, and opinions about education and the University. A 16-page questionnaire containing forty-nine questions was sent to 5600 graduates who received a bachelor degree in engineering between June, 1911 and June, 1956. The data presented was based on the responses of 3799 alumni; each of whom returned a deck of four IBM cards upon which their answers to the forty-nine questions were recorded with an electrographic pencil for machine scoring and tabulation.

The questionnaire data were reported by four major categories; namely, the type of engineering degree award, the year of graduation, the job function in which current employment was held, and scholastic standing at time of graduation. Between 1911 and 1956 Purdue University awarded engineering degrees in Aeronautical Engineering, Agricultural Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering Law, Engineering Mechanics, Mechanical Engineering, and Metallurgical Engineering. Data by job function were reported in seventeen categories. The data by scholastic rank were restricted to that group of graduates who received their degree between 1931 and 1946; a total of 1351 alumni were included in the scholastic rank data.

The data on college experiences revealed that approximately 70 per cent of the alumni received a bachelor degree in four years. Alumni who ranked in the upper half of their class academically graduated in four years at a higher rate and were about one year younger than those who ranked in the lower fifth. The alumni were generally satisfied with their high school preparation; however, they felt that preparation was better in mathematics, English and physics than in chemistry. Ninety per cent of the alumni thought English composition and Speech were very important to the college engineering curricula. The alumni recommended engineering curricula did not include as many credit hours in the humanities and social sciences as suggested in the current reporting of engineering educators.

Job experience data indicated that (1) the typical graduates had no more than three employers during their careers; (2) three out of every four alumni were employed in private industry; (3) over 80 per cent pursued an engineering career throughout their active working years; (4) during the earlier years about 35 per cent were engaged in research, development and design functions; (5) within twenty-five years about 1 out of 3 were engaged in technical management; (6) it required approximately twenty-five years for one to reach his top job position; and (7) salaries increased rapidly after graduation but alumni whose salaries were above the median had the best opportunities for salary increases beyond twenty years of job experience.

The postcollege communities in which the alumni resided were usually larger than their precollege homes. Other personal information revealed that the majority felt that union membership was not compatible to a professional status. Eighty-five per cent of the alumni expressed satisfaction with their career; 90 per cent were satisfied with their choice of engineering curriculum; and 82 per cent would again choose engineering if they were to begin anew their college study.

The above findings as well as others reported in the study could be of value to teachers, counselors and administrators engaged in engineering education.

Microfilm $3.30; Xerox $11.40. 256 pages.

A COMPARISON OF TRANSFER AND NON-TRANSFER PUPILS IN THE PETERSBURG, INDIANA, HIGH SCHOOL

(L. C. Card No. Mic 58-5221)

William A. Weathers, Ed.D.
Indiana University, 1958

Chairman: Louis G. Schmidt

The objective of this investigation was to compare the adjustment of pupils enrolled in Petersburg High School whose legal residence was within the city (non-transfer pupils) with that of pupils whose legal residence was in adjoining townships (transfer pupils).

The investigation was confined to the study of 160

transfer pupils and 148 non-transfer pupils who were enrolled in Petersburg High School for five or more grading periods during the school year 1955-1956. In order that social adjustment might be evaluated, the transfer group was further divided into 105 non-farm pupils and 55 farm pupils.

Comparisons of the transfer and non-transfer groups were made in relation to grade point average, attitude toward high school, activity points earned, and the number of drop-outs. Comparisons of the non-transfer, non-farm and farm groups were made in relation to sociability and social acceptance status. Four of these comparisons were made by applying the t-ratio test to null hypotheses concerning the differences between the means of the groups. No tests of significance were employed in comparing the social acceptance status of the non-transfer, non-farm, and farm groups or of the number of drop-outs from the transfer and non-transfer groups.

Findings:

1. There was no significant difference in the mean grade point average of the transfer and non-transfer groups.
2. There was no significant difference in the mean high school attitude scores of the transfer and non-transfer groups.
3. There was no significant difference in the mean number of activity points earned by the transfer and non-transfer groups.
4. There was no significant difference in the number of drop-outs from the transfer and non-transfer groups.
5. The difference between the mean sociability scores of the non-transfer group and the farm group was significant at the one per cent level, and between the non-transfer group and non-farm group at the five per cent level.
6. The median social acceptance scores of the non-transfer group were more often greater than that of the transfer group, and those of the non-farm group were more often greater than those of the farm group.

Conclusions:

1. There were no significant differences between the transfer and non-transfer groups in their adjustment to the curricular and estracurricular offerings of the school or in the number of drop-outs.
2. The social adjustment of the non-transfer pupils was superior to that of the transfer group.
3. The sociability of the non-transfer group was superior to that of the transfer group.
4. The social acceptance status of the non-transfer group was somewhat superior to that of the transfer group, and that of the non-farm group was somewhat superior to that of the farm group.
5. The isolation of rural life has a modifying effect on the inclination of rural pupils to make social contacts outside of the immediate family circle.
6. When viewed from an over-all standpoint, the adjustments of transfer and non-transfer pupils were so similar that it should not be a deterring factor in the consolidation of the school districts concerned.

Microfilm $2.55; Xerox $8.80. 195 pages.

IMPROVEMENT IN COLLEGE TEACHING THROUGH MORE EFFECTIVE INTERPRETATION OF LANGUAGE (VOLUMES I AND II)

(L. C. Card No. Mic 58-3473)

Harry Sheridan Wilder, Ph.D.
The Ohio State University, 1958

In this study, the writer is concerned with the ascertainment of the extent to which the written work of university students (in this instance students attending The Ohio State University) exhibits inaccurate and incomplete interpretation of language and of the nature of this inaccurate interpretation. The research is restricted to the areas of the social studies, English, and professional education, and to examination papers written by students for these courses.

After a discussion of the goals of higher education, the writer considers in some detail the following major aspects of semantics: abstraction, symbols, contexts, forms of to be, two-valued orientation, and emotive language. He then discusses the ways in which semantics may assist in promoting the objectives of higher education. Next, on the basis of the aspects of semantics listed above, he analyzes student-written responses to examination questions (eighty-six in economics, seventy-five in history, fifty-five in sociology, seventy-two in English, and seventy-six in professional education). In the light of the findings, he suggests ways in which a university may assist its students in more effectively interpreting language and thus more effectively communicating ideas.

From the analyses and the summaries, the following conclusions are drawn: (1) Weakness is shown in the use of systematic, controlled thinking in the analysis of a given problem. (2) In the verbal communication of ideas, lack of comprehension of both the potentialities and the limitations of words is shown. (3) Effectiveness of communication is lessened by lack of orderly, systematic presentation and by unclear grasp of the difference between facts and judgments. (4) Insufficient interdepartmental co-operation is indicated.

Major SPECIFIC recommendations include, for abstraction: definition; analysis of passages; written and oral practice in the selection and arrangement of abstractions; exercises in developing paragraphs and groups of connected paragraphs; for symbols: explanation of the Ogden-Richards Triangle of Reference; practice in revision of responses; studies of implicit acceptance of word-magic; for contexts: analysis of selected terms in various contexts; analysis of student-written answers; the use of superior answers for contrast; for uses of to be: the employment of the inductive method to explain the principle of equivalence; explanation of the results of confusion of the levels of abstraction; analysis of passages from the work of professional writers. Suggestions for working with two-valued orientation include review of the nature of signal reactions; discussion of superior or excellent answers; analysis of the relationship between the development of two-valued orientation and the use of antithesis; for connotation: listing of personal and general connotations of emotion-charged words in the context of responses; review of the principles of valid generalization; close analysis of emotive passages

from textbooks or articles; for metaphor: explanation of metaphors in responses; analysis of metaphors in advertisements and political articles; expansion of metaphors; for slanting: analysis of selection of detail in newspaper articles; consideration of responses which combine slanting with the use of highly connotative terms; writing and analysis of several acceptable answers to appropriate topics.

GENERAL recommendations include training in logic; instruction in major aspects of semantics; analysis of items from books, magazines, and newspapers for accuracy in thinking and in expression; the wide use of charts, diagrams, and graphs; and the use of examples of direct, accurate answers.

Microfilm $11.20; Xerox $37.44. 886 pages.

EDUCATION, ADMINISTRATION

COMPARISON OF CONNECTICUT SUPERINTENDENTS' BELIEFS CONCERNING JOB EXPECTATIONS OF EXPERIENCED TEACHERS WITH REPORTED EXPECTATIONS OF THE SAME TEACHERS

(L. C. Card No. Mic 58-3901)

Stephen August, Ph.D.
The University of Connecticut, 1958

There were two purposes in this study: (1) to discover whether or not there are significant differences between what superintendents believe experienced teachers are looking for, and what experienced teachers are really looking for in a new job; (2) to discover whether or not there are significant differences between male and female teachers, and also between married and single teachers with reference to important considerations when seeking new jobs.

Information concerning the beliefs of 1248 teachers and of 120 superintendents about teacher beliefs of job expectations of experienced teachers was obtained from questionnaires.

Two statistical measures were used to find significant differences: (1) Critical Ratio, (2) size of the difference. Statistical results of the comparisons made it possible to answer the following questions:

1. Are there any significant differences between what superintendents believe experienced teachers are looking for, and what experienced teachers are really looking for in a new job?
2. Are there any significant differences between male and female teachers, and also between married and single teachers with reference to important considerations when seeking new jobs?
3. What implications may be drawn from those items showing real significant differences for superintendents and teachers when experienced teachers seek new employment?

Superintendents thought teachers attached more importance to the following than did teachers:

1. Salary credit for military and previous teaching experience.
2. Opportunity to meet eligible persons of the opposite sex.
3. Availability and cost of rooms, board, and houses or apartments for rent.
4. General cost of living in the town.
5. College or university training.

Teachers really attached more importance to the following than did superintendents:

1. Kind and frequency of reports to parents, principals, superintendents, and other school officials.
2. Pupils' records to be kept.
3. Provisions for participating in the establishment of policies which concern the teacher, and participating in the selection of school supplies.
4. Promotion of pupils.
5. Organization of the school system.
6. Loyalty oath.
7. Accessibility of pupil records.
8. Classroom and school library.
9. The number and composition of the board (sex, age, occupation, education), the method of their selection or election, politics, and relationship of board to teachers.
10. Whether or not the board has written policies, and are available to teachers.
11. Availability of professional library.
12. Philosophy of education.
13. Location of tailor shops.

One really significant difference was found between beliefs of male and female teachers, namely, male teachers attached more importance to granting salary credit for military experience than did female teachers.

There were no really significant differences between reactions of married and single teachers.

Data reveal that with respect to items listed above, superintendents are not aware of what newly employed experienced teachers are really looking for. Teachers are much more concerned with professional matters than with economic matters, whereas superintendents are more concerned with costs than with professional matters.

Male teachers were more concerned with salary credit for military experience than were female teachers.

Implications

1. There is need for better communication between superintendents and teachers with respect to job satisfactions and expectations.
2. There is a marked need for teacher handbooks which clearly answer questions about which teachers are really concerned.
3. Superintendents should be much more careful in planning and in executing interviews.
4. There is a marked need for improved orientation programs.

Microfilm $2.00; Xerox $5.80. 119 pages.

AN ANALYSIS OF SELECTED FACTORS WHICH AID OR DETER SCHOOL DISTRICT REORGANIZATION IN CERTAIN INDIANA COUNTIES

(L. C. Card No. Mic 58-5198)

Carl Edward Bickley, Ed.D.
Indiana University, 1958

Chairman: Howard T. Batchelder

Problem: The purpose of this study was to investigate two extreme groups of counties (extensively reorganized and totally unreorganized) in an effort to determine whether or not certain factors could be established as characteristics aiding or deterring school district reorganization. It was thought that an understanding of these factors might be essential in planning constructive legislation which would encourage adequate school district reorganization.

Procedure: In the initial steps of the study a review of related literature was made and noted authorities were consulted in order to ascertain what factors others had reported as aiding or deterring school district reorganization. After the factors to be used in this study had been carefully selected, the following procedures was employed: (1) the selected factors were stated in the form of hypotheses, (2) the hypotheses were submitted to a jury of experts for validation, (3) a questionnaire was sent to city and county superintendents in the selected counties, and (4) the data collected were placed in tabular form and analyzed.

Findings and conclusions: The major findings and conclusions resulting from an analysis of the data are:

1. When the highest adjusted assessed valuation per resident pupil is twice the lowest adjusted assessed valuation per resident pupil within a county, school district reorganization is deterred.
2. There is some evidence that, when the highest school tax rate is twice the lowest school tax rate within a county, school district reorganization is deterred.
3. Population increases and decreases reveal no evidence of affecting school district reorganization.
4. Changes in population centers within a county appear to have no direct effect upon reorganization.
5. Urban and rural differences do not deter school district reorganization to the extent that is commonly believed.
6. There is some evidence that the existence of nonpublic schools within the county deters reorganization.
7. When a majority of the school corporations within a county have a high school, school district reorganization is deterred.
8. When a majority of the school corporations within a county have been surveyed, school district reorganization is aided.
9. When not more than one or two school corporations have been surveyed within a county, school district reorganization is deterred.
10. When there has been long tenure of county superintendents, school district reorganization is deterred.
11. When there has been long tenure of city and town superintendents, school district reorganization is deterred.
12. Although politics affects reorganization, it could not be definitely concluded that a one-party political domination of a county deters school district reorganization. Microfilm $2.10; Xerox $7.40. 160 pages.

DESIRABLE AND UNDESIRABLE BUILDING FEATURES AND SPACES IN SELECTED TEXAS ELEMENTARY SCHOOLS

(L. C. Card No. Mic 58-5101)

Louis Albert Bohn, Ed.D.
The University of Texas, 1958

Supervisor: Dr. Henry J. Otto

The need for an inventory and appraisal of the space and facility innovations incorporated into recently constructed elementary schools prompted the study reported in this dissertation. The problem of the study was threefold: (1) to identify the features and spaces incorporated into recently constructed elementary schools; (2) to ascertain the useful aspects and undesirable characteristics of each innovation; and (3) to obtain some appraisal of the usefulness of building innovations in facilitating the instructional program and the operation of the school.

Twenty-six recently built elementary schools possessing innovations in design and facilities were selected for study. Only those items which could be considered as an integral part of the building itself, such as storage units, teaching surfaces, toilet facilities, sinks, work counters, and the like, were given attention in this study.

The data necessary for this study were obtained through three main sources: (1) a careful study of current literature which included architectural periodicals, pamphlets, books, and related research studies; (2) responses to questionnaires and checklists by principals and architects of the twenty-six buildings; and (3) personal visitation and interviews with teachers and principals in the twenty-six buildings.

The problem of determining what constituted innovations in elementary school building design features to be included in the checklist and in the appraisal instrument was met in the following ways: (1) a list of new ideas in the field of elementary school design was compiled from a survey of the general literature on the subject; (2) a study of the research made in the area; and (3) conversation with school architects and school planning consultants.

The findings of the study indicated that the following building features and spaces were desirable for elementary schools: (1) classrooms with a large amount of glass which permitted children to see outside and admitted an abundance of natural light to enter the classroom; (2) certain types of classroom-corridor combinations which provided additional teaching space; (3) movable storage cabinets; (4) adequate chart storage facilities; (5) sheltered play areas; (6) paved play areas; (7) patios; (8) windbreaks; (9) large playgrounds; (10) provisions for classroom dining; (11) the division of large cafeterias into small dining spaces by means of partitions;

(12) common room toilets for primary children; (13) air conditioning in some parts of Texas; (14) teaching space dividers; (15) nonload-bearing walls; (16) large classrooms; (17) adequate chalkboard, pegboard, and bulletin board; (18) sinks; (19) low work cabinets; (20) drinking fountains located in classrooms; (21) reduced ceiling heights; (22) bubble skylights; (23) playrooms; (24) arts and crafts rooms; and (25) central libraries.

The following undesirable features and facilities were identified in some buildings: (1) small classrooms; (2) inadequate storage space; (3) inadequate sun and sky glare controls; (4) lack of acoustically treated ceilings; (5) lack of adequate sound control devices in certain types of classroom-corridor combinations; (6) lack of room darkening facilities; (7) a certain type of built-in combination bulletin board and storage space; (8) a certain type of chalkboard in sliding sections; (9) a single heat control unit for two or more classrooms; (10) areas in which noisy activities took place were sometimes located too near the classrooms; (11) inadequate facilities to insure toilet privacy; and (12) lack of suitable all-weather facilities for play and physical education.

Microfilm $3.05; Xerox $10.40. 234 pages.

GRANTS-IN-AID AND EQUALIZATION OF EDUCATIONAL OPPORTUNITY IN WISCONSIN

(L. C. Card No. Mic 58-5329)

Dale Leroy Bolton, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Russell T. Gregg

This study investigated grants-in-aid to selected integrated school districts in Wisconsin to determine:

1. the effectiveness of present grants-in-aid in equalizing educational opportunity and taxation burden among districts,
2. specific factors related to lack of equalization, and
3. the effect which modifications of these factors would have on equalization.

In order to compare effectively the expenditures for educational opportunity, it was necessary to utilize only expenditures related to quality. This required a selection of districts that did not have excessive expenditures related to size of operation. The selection of the 131 integrated school districts studied was made on the basis of examination of empirical evidence and expressions by authorities.

Treatment of the data, which was obtained from the State Department of Public Instruction, included computation of the descriptive measures of range, median, mean, standard deviation, and coefficient of variation. These computations used 1956-1957 data for variables pertinent to equalization of educational opportunity and taxation burden. The statistical techniques of analysis of variance, Pearson product-moment correlation coefficient, and Student t test were utilized where appropriate. Hypothetical conditions which provided maximum variation in amount of funds and type of allocation were described by designed formulas. Data were obtained from use of these formulas, and results were compared in order to determine conditions which minimized variation in educational opportunity and taxation burden. Methods were illustrated whereby the measures of standard educational opportunity and minimum taxation burden could be determined objectively and incorporated in a method of distribution of state funds. This method of distribution was compared with the 1956-1957 method of distribution for the purpose of determining which method provided the most equalization of educational opportunity and taxation burden.

The findings and conclusions of this study included:

1. The range of educational opportunity in 1956-1957 for the districts studied was $270 and the coefficient of variation was 15.13. If no state aids had been received and the full value mill rate had remained constant, the range of educational opportunity would have been $320 and the coefficient of variation would have been about one and one-half times the actual variation.
2. The range of taxation burden in 1956-1957 for the districts studied was 10.2 and the coefficient of variation was 20.99. If no state aids had been received and the educational opportunity had remained constant, the range of taxation burden would have been approximately four times the actual taxation burden and the coefficient of variation would have been approximately twice the coefficient of variation for 1956-1957.
3. There was no evidence to suggest that the factors of: (1) per cent of private and parochial pupils attending school in the individual school districts, (2) utility taxes received by the districts, and (3) geographical location of the districts were significantly related to equalization of educational opportunity and taxation burden in the districts studied.
4. The method of distribution of funds and the amount of funds distributed by the state were found to be related to the extent of equalization of educational opportunity and taxation burden.
5. Utilization of a new method of apportionment and increased funds indicated that if funds were distributed to these 131 districts by means of an equalization formula which used objective methods for determining the standard minimum educational opportunity and minimum taxation burden, a higher level of educational opportunity, a lower full value mill rate, less variation in both educational opportunity and taxation burden, and greater equity of distribution would result. All of this could occur within a decentralized framework of administration which would allow local initiative beyond the minimum requirements through utilization of the available tax-leeway.

Microfilm $3.25; Xerox $11.20. 251 pages.

A STUDY TO DEVELOP A GUIDE FOR USE IN ESTABLISHING OR EVALUATING SPECIAL PROGRAMS FOR THE MENTALLY HANDICAPPED

(L. C. Card No. Mic 58-3906)

John Thomas Cassell, Ph.D.
The University of Connecticut, 1958

STATEMENT OF THE PROBLEM: A survey of literature relative to programs for the mentally handicapped indicates that although special programs have been in existence in the United States since 1896, there are today few sources of compiled information readily available to assist school personnel in the establishment or operation of a special class. Here is need for a critical analysis of the education of mentally handicapped pupils in the public schools of Connecticut.

PURPOSE OF THE STUDY: This problem was analyzed by securing information relative to existing conditions in the public school classes for mentally handicapped in the State of Connecticut, coupled with special class teacher opinions and published recommendations of authorities in the field. Pertinent information was then organized into a meaningful pattern which will serve as a guide, for use (1) in establishing classes or (2) in comparing existing programs with proposed programs resulting from this study.

METHOD OF THE STUDY:

1. A questionnaire, composed of seventy-four items, covering various aspects of the programs for the mentally retarded was prepared (1) to serve as a basis for obtaining information concerning the practices used in the public school special classes in Connecticut, and (2) for obtaining recommendations from the teachers conducting these classes.
2. All professional literature which seems to have a bearing on special programs was examined and opinions offered relative to the program aspects covered in the questionnaire were recorded.
3. The information secured from the questionnaire, both current practices and teacher recommendations was analyzed, charted, and summarized.
4. The final step was the presentation of material classified and organized according to phase or program aspect compiled from the three sources with the consensus of opinion serving as the basis for the recommended guide.

RESULTS: Specific recommendations pertaining to the following are presented: classroom location, size and special facilities, class size, chronological age range span, co-educational classes, term used to identify class, curriculum guides, length of school day, provisions for lunch, departmentalization of special classes, occupational education, guidance, placement and follow-up services, transportation, medical examinations, achievement tests for educable classes, cumulative records, accessibility of pupil records, marking and reporting, parent relationships and conferences, teacher qualifications, salary differential, supervision of special classes, special departments, faculty meetings, and relationship of special classes with regular classes.

CONCLUSIONS:

1. There was a consistently high degree of agreement between special class teacher suggestions and recommendations, and the suggestions and recommendations presented by the recognized authorities.
2. There was reported in a number of instances a marked similarity in certain program aspects between special and regular classes.
3. The insufficient number of special classes has in many instances caused existing classes to deviate widely from recommended procedures by overcrowding these classes with pupils of both wide ability ranges and wide chronological age ranges.
4. There is an apparent lack of adequate provisions for the younger and for the older retardates of school age; and, for those for whom programs are being provided, there appears to be a tendency to offer similar programs to all groups.
5. This study provides grounds for assuming that the supervision of many special classes is inadequate because supervisors are untrained and unfamiliar with the problems common to this area of education.

Microfilm $2.60; Xerox $9.00. 197 pages.

THE CURRICULUM OF THE GREEK GYMNASIUM

(L. C. Card No. Mic 58-3907)

Thomas Stavros Claros, Ph.D.
The University of Connecticut, 1958

The problem in this study was to describe the curriculum of the Greek gymnasium, grade by grade and subject by subject, so that a complete picture of this curriculum could be available to educators and laymen in the United States.

In the process of inquiry it soon became evident that the subject had received little attention in the United States. However, by writing to Greek educators, friends, and to the Greek Ministry of Education, the investigator found the necessary information to complete the study.

The gymnasium was found to be the approximate equivalent of a classical high school in the United States, and the curriculum was called the analytical program of secondary education. Other secondary schools were the commercial schools, the lycea which were private schools, the practical lycea which stressed sciences and mathematics, agricultural schools and biotechnical schools which trained students in specific trades.

The secondary educational system was organized by King Otto in 1833, and patterned after the Bavarian and French systems of education. At first its aims were extremely nationalistic, but in the last twenty-five years emphasis was placed on the needs of modern Hellenic civilization and international understanding. This system underwent three major changes. In 1929 the gymnasium was increased from four to six years, in 1937 to eight years and in 1951 it reverted to six years. It was found that the federally operated secondary system was highly centralized under the Ministry of Education, the Supreme Board of Education, the Central Service Council of Secondary Education and the Secondary Directorate.

All gymnasium teaching personnel, called professors, were graduates of higher institutions or universities, and received special training in the School of Secondary Education for two years. In 1957 the monthly salary of newly appointed professors was approximately sixty dollars.

The subjects taught in the six grades of the Greek gymnasium were religion, ancient Greek, modern Greek, Latin, French, English, history, education of the citizen, mathematics, cosmography, sciences, geography, home economics, hygiene, philosophy, technical, music and physical education. These subjects were compulsory with only three exceptions. Religion was required only of students of Greek Orthodox faith. Second, a student could elect either French or English as a foreign language, and music was an elective in the fifth and sixth grades.

The curriculum indicated that each student in the first four grades had thirty-five hours of classroom work per six day week, thirty-six in the fifth, and thirty-seven hours in the sixth grade. He was taught eleven different subjects in the first and second grades, twelve in the third and fourth, thirteen in the fifth, and ten subjects in the sixth grade. Forty-six per cent of the student's time was devoted to the study of languages, and twenty-four per cent to the study of ancient Greek.

Statistics showed that less than twelve per cent of gymnasium graduates entered schools of higher education. Most educators felt that the gymnasium curriculum prepared students in an excellent manner for university level institutions, but failed to enrich their minds with original thinking and ability to make sound decisions, which were necessary for a successful life. Reading, memorization and recitation without exercising original thoughts or expressing critical opinions, did not prepare the graduate for living in a complex society.

The basic conclusion of this study was that the 1929 curriculum did not meet the modern needs of the majority of students and that a change was imperative for a better education of all Greek youth.

Microfilm $2.30; Xerox $8.20. 176 pages.

THE ELEMENTARY SCHOOL PRINCIPAL AT WORK WITHIN THE LOCAL ORGANIZATIONAL FRAMEWORK FOR ADMINISTRATION AND SUPERVISION

(L. C. Card No. Mic 58-5102)

Dwain McKinley Estes, Ed.D.
The University of Texas, 1958

Supervisor: Dr. Henry J. Otto

The problem of this study was three-fold: (a) to ascertain the organization for administration and supervision in one school system, (b) to study the actual functioning of elementary principals within this organizational framework, and (c) to identify some of the personal characteristics which might shed light on the reasons why different principals function differently within the organizational framework of the same school system.

A hypothetical model containing some of the personal characteristics which appeared to be needed by an effective elementary principal in the system was developed to provide a criterion by which the personal characteristics of the eleven principals in the study could be compared. The model included the principal's self-adjustment, achievement drive, and adjustment to others.

The organization for administration and supervision as well as the principals' methods of operation were ascertained through interviews with the central staff, principals, and teachers. Information regarding the principals' personal characteristics was obtained from projective instruments (Biographical Data Form and Sentence Completion Instrument), and was corroborated and supplemented by interviews with the principals, their wives, their teachers, and members of the central staff. For the study as a whole a total of 124 interviews were conducted which consumed $137\frac{1}{2}$ hours. Twenty-one different instruments were prepared for use in these interviews.

One of the greatest values of this research lies in its method of attack. The method in which the personal characteristics were determined, and the plan for getting a realistic picture of how a principal functions within an organizational framework of a given school system appear to be worthy of further use.

In this study the organization for administration and supervision was found to be highly centralized, with relatively little important authority vested in the elementary principalship. Even so, the principals generally did not meet the requirements of the organizational framework. The degree to which each principal carried out the responsibilities given him seemed to depend more on his personal characteristics than on the requirements of the framework.

This research seems to show very clearly that it is relatively meaningless to consolidate returns from a survey type of study and say that this is what principals do. The heart of the principal's behavior seems to lie in "what kind of principal, in what kind of school, in what kind of school system" rather than in survey data which lump into frequency tables the activities of many kinds of principals in many kinds of school situations.

The study also points up the need for those institutions which prepare school administrators to take into consideration the trainees' personal characteristics, and develop a program which will aid in the improvement of these characteristics. This calls for a determination of the personal characteristics that are needed, a method by which personal characteristics can be identified, and a method by which personal characteristics can be improved. Likewise, institutions training school administrators have an obligation to help place individuals in school systems in which the organizational framework provides a supporting environment favorable to their success. Microfilm $7.15; Xerox $25.00. 561 pages.

THE EMERGENCE OF PUBLIC EDUCATION AS A FUNCTION OF THE STATE IN VERMONT

(L. C. Card No. Mic 58-3914)

Clyde Greenleaf Fussell, Ph.D.
The University of Connecticut, 1958

The purpose of the study was to determine whether public education in Vermont was a local or state function.

The historical method was used in the treatment of the problem. Vermont's history was divided into three periods: the colonial period from 1720 to 1777, the period of the Republic of Vermont from 1777 to 1791, and the period of statehood from 1791 to the present. The three Constitutions of Vermont, the Constitution of the United States, judicial decisions of United States courts and the Vermont Supreme Court dealing with educational questions, and educational legislation were studied and analyzed.

Although first settlers in Vermont attended to education in their families, they soon saw the need of schools as communities grew. The charters which had been granted to towns provided that income from lease lands be used for the support of schools. However, the management of schools was local in nature. The first constitution of the Republic, like its successors, required that schools be established in each town. Legislation which was enacted by the Assembly during the Republic also provided for the establishment of school districts. With the formation of a central government education emerged as a state function with some controls left with the people locally. From that time on, whatever local units of school government did, they did by sufferance of the state government under regulations passed by the state legislature.

In the early years of statehood, the situation was similar to what it had been under the Republic. The tendency as the years progressed was for the state legislature to exercise more control and to delegate powers and duties to local boards.

While the first laws provided for formation of districts, the state determined the type of districts and supervisory units which were to constitute the local units of school government. There were many changes made but only by authority of the General Assembly. Even though local units had had control of such matters as size of school site, construction of school buildings, location of schools, certification, selection and contracting of teachers, operating schools, establishing tuition rates, developing courses of study, choice of textbooks, transportation, school attendance and length of school year, gradually, consistently, and definitely the state legislature has exercised control in these areas. Ever since 1786 towns have been obliged to maintain schools. From 1797 to the present the state has required towns to raise a tax for school support. The state has given ever increasing amounts to the towns in the form of general grants-in-aid as well as specific grants-in-aid. By so doing the state has exercised control over local communities.

It was concluded that in Vermont (1) the original charters subsidized schools but education in colonial Vermont was a local function, (2) from the very beginning while Vermont was an independent Republic, education was recognized as a state function; provision for education appeared in the constitutions of the Republic, (3) public education has consistently been recognized as a function of the state by Vermont as one of the United States and local boards or committees have been considered to be arms of the state exercising powers and duties granted through acts of the state legislature, and (4) in the State of Vermont public education has emerged as a function of the state. Microfilm $2.00; Xerox $5.20. 104 pages.

PRIVATE JUNIOR COLLEGE LEGISLATION IN THE UNITED STATES

(L. C. Card No. Mic 58-3915)

Edward John Gacek, Ph.D.
The University of Connecticut, 1958

Statement of the Problem

The main purpose of this study was to make an analytical evaluation of the prevailing legal and regulatory provisions pertaining to the establishment and operation of private junior colleges in the United States and the territories. The problem was resolved into four divisions of inquiry: (1) To determine what legal enactments exist concerning the establishment of private junior colleges; (2) to ascertain what legislation has been enacted relative to the authorization of private junior colleges to grant degrees; (3) to discover current legislation pertinent to the inspection and licensure of private junior colleges; and (4) to present current legislative provisions underlying the accreditation of private junior colleges.

Method of Procedure

The data were derived from the chief educational officers of the forty-eight states, the District of Columbia, and the six territories. In states where needed information was not obtainable, copies of school codes, general statutes, and special acts were acquired and examined.

The first phase traced the historical development of the private junior college. This was accomplished by an analysis of the structural growth of junior colleges since 1750 and a presentation of statistical data evidencing such growth.

The second phase was concerned with an examination of the judicial experiences of private institutions of higher education with special attention focussed on private junior colleges. This was determined from a study of various laws, court decisions, and litigation initiated.

The third phase was one of determining criteria for the evaluation of prevailing private junior college legislation. The criteria were selected on the basis of an analysis of the primary data presented in the study.

The fourth phase was an evaluation of the legislative provisions pertaining to the establishment and operation of private junior colleges in accordance with the selected criteria.

Results

1. While 40 states, the District of Columbia, and four territories have private junior colleges, only 20 states and one territory provide general legislation pertaining to the establishment of private junior colleges.

2. In a majority of the states, private junior colleges are chartered under general corporation laws of these states.

3. In a preponderant number of states, the authorization to grant associate degrees is based on the incorporation of the private junior college in accordance with general corporation laws.

4. Fifty-four per cent of the states and territories provide general legislation concerning the inspection of private junior colleges.

5. Eight states and the District of Columbia, representing eighteen per cent, require licensure as a prerequisite to the establishment of a private junior college.

6. The state university is the legally prescribed authority for accrediting private junior colleges in the largest number of states and territories.

Conclusions

1. The enactment of legislation pertaining to private junior colleges, during the past thirty years, has not followed any methodical pattern of development.

2. A number of states have not exercised their legal function in enacting legislation affecting private junior colleges.

3. Licensure should be required of junior colleges as a prerequisite to the legal establishment of degree-granting institutions.

4. A predominant number of private junior colleges are controlled by or affiliated with a religious denomination. Microfilm $4.05; Xerox $13.80. 316 pages.

THE PUBLIC SCHOOL PRINCIPAL'S OPERATIONAL BEHAVIOR, THEORY AND PRACTICE, AND RELATED SCHOOL AND COMMUNITY INTERACTIONS, BASED ON DATA FROM THE INVESTIGATIONS OF THE UNIVERSITY OF FLORIDA CPEA LEADERSHIP PROJECT

(L. C. Card No. Mic 58-3507)

Hulda Gross Grobman, Ed.D.
The University of Florida, 1958

The University of Florida has been engaged in a Leadership Study for several years as part of the nation-wide Cooperative Program in Educational Administration, with grants from the W. K. Kellogg Foundation. The present study is the last in a series of 17 studies of educational leadership, which focus on the operational pattern of the public school principal and its relation to the school community. The purpose of the present study is to coordinate and synthesize the findings of these earlier studies, to make their findings available in a single work, to analyze further the data already collected on the principalship and the school community, and to derive new knowledge and understandings from a further analysis and a coordination of the earlier studies.

This study includes first a summary of earlier findings on the operational pattern of the principal and its effect on school-community relations. Then, it presents a profile of the "typical" principal included in this study, in his on-the-job behavior when interacting with teachers individually, with the faculty as a whole, with pupils, and with parents and community in terms of 86 interaction situations common to all principals. This profile is then compared with the operating pattern considered by experts in administration to be "best practice." Consideration is also given to the extent to which the typical principal and the best-practice principal patterns of behavior are democratic; how elementary and secondary principals differ in operational behavior patterns; and how the more democratic principals and the more nondemocratic principals differ in their on-the-job behavior.

Third, there is a consideration of school-community factors of: parent opinion of and interaction with the school; teacher attitudes toward profession and school; teacher level of professional activities; and pupil attitudes toward self and others. Each of these is considered in terms of the general picture, and of the influence of level of school, operational pattern of the principal, and other variables.

The study concludes with a summation of the major findings of all the researches in the Florida Leadership Study on the principal operational pattern, and a consideration of several of the major findings, and their implications for colleges of education.

The major general findings of the Project studies are:

1. Seventy-seven per cent of the combined teacher-pupil-parent-community reaction to the school can be accounted for in terms of six factors--the democratic operating pattern of the principal as measured by the Principal Behavior Check List developed in the Study; his score on the F Scale; his score on Factor A of the GAMIN (a negative influence); the number of years at his Rank level in the Florida system; the size of his school (a negative influence); and the income level of his school community. The democratic operating pattern accounts for two-thirds of this, or almost half the variance.

2. The principal with the democratic operational pattern evokes a more favorable response from teachers, pupils, parents, and community.

3. Elementary schools generally receive more favorable attitudes from teachers, pupils, parents, and community than junior and senior high schools.

4. The income level of the school community directly affects parent, teacher, and pupil favorable attitudes.

Both the school level and the income level influences are high lighted in the present study, whereas previous studies dwelt more specifically with principal operational pattern influences. The major contributions of the present study are: an adding of supportive data to the earlier findings and a development of new findings based on new computations of the data; a pin pointing of the specific attitude and activity areas where the differences occur; a summation of the findings of all studies to permit a more systematic analysis of their implications; a seeking of some common elements or values involved in the differences; and a hypothesizing on some causative factors and their implications in college educational training programs. Microfilm $4.25; Xerox $14.40. 331 pages.

PROMISING LEADERSHIP TECHNIQUES USED BY PRINCIPALS OF CONNECTICUT SECONDARY SCHOOLS

(L. C. Card No. Mic 58-3921)

Harold Elton Healy, Ph.D.
The University of Connecticut, 1958

The purpose of this study was to locate promising practices or techniques which secondary school principals might use in supplying professional leadership to teachers. More specifically this study has sought the answers to the following questions:

1. What techniques of leadership have principals of Connecticut secondary schools found to be successful?
2. What techniques of leadership have principals of Connecticut secondary schools found to be unsuccessful?
3. What techniques reported in the literature as techniques of promise have never been tried by the principals of Connecticut secondary schools?
4. To what extent do the dimensions of the group of teachers with whom a principal works affect the success of techniques of leadership employed by the secondary school principal?

A questionnaire was developed to secure information pertaining to the faculties with whom the principals worked and also an evaluation of the leadership techniques which have been tried. This questionnaire was sent to one-hundred forty-one secondary schools in Connecticut. Seventy-eight principals responded. These responses were used in the study.

For the purpose of finding answers to the fourth question posed as subsidiary to the problem of this study, it was decided to analyze the success or failure of techniques of leadership in terms of the dimensions of the faculties. The dimensions used were size, viscidity, homogeneity, flexibility, permeability, polarization, intimacy, hedonic tone, participation, and dependence.

Two formulas were used in this study; one to determine the index of probable success for each leadership technique, and the other to test the difference between the evaluations of the principals working with different types of faculties.

The study disclosed thirty-nine leadership techniques which have been tried and found successful by the respondents to this questionnaire. Some of these are:

Have individual conferences with each faculty member to show an interest in what he is doing.

Tell faculty members about compliments and achievements about which he has heard or read.

Delegate authority to competent faculty members by designating certain members to be chairmen of committees.

Schedule faculty meetings at the beginning of the school year.

Have a requirement of in-service credits in order to advance on the salary schedule.

Although there were no techniques which were evaluated as unsuccessful by every respondent, there were some techniques which were not considered as successful as others.

Every technique listed in the questionnaire was reported as having been tried by at least a small percent of the responding principals. This study revealed thirteen leadership techniques which have never been tried by over fifty percent of the respondents. The percent of responding principals who have never tried the technique is given for each of the following:

Set up a committee to help select new teachers. (93%)

Provide an opportunity for teachers to formulate a set of qualifications for new teachers and newly developed positions. (96%)

Hold faculty meetings before school in the morning. (87%)

It was found that the following techniques can be considered promising irrespective of the dimensions of the faculty:

Have individual conferences with each faculty member to show an interest in what he is doing.

Tell faculty members about compliments and achievements about which he has heard or read.

The data obtained for this study showed that the technique of providing an opportunity for teachers to volunteer for stated duties showed that this technique was found to be successful by principals working with faculties rated high in hedonic tone (morale) and unsuccessful by principals working with faculties rated low in hedonic tone.

Microfilm $5.60; Xerox $19.80. 438 pages.

EXTENT, NATURE, PURPOSES, STRUCTURE, AND OPERATIONAL PRACTICES OF CITIZEN COMMITTEES IN EDUCATION IN WISCONSIN

(L. C. Card No. Mic 58-2567)

Arthur Garfield Mc Graw, Jr., Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Russell T. Gregg

The purpose of this study was to discover, collect, evaluate, and report information on the extent, nature, purposes, structure, and operation of citizen committees in education with particular reference to those committees in Wisconsin school districts which support high schools. Committees studied in Wisconsin included only those which were active sometime during the period 1953-1955.

Procedure

An initial inquiry was sent to all chief school administrators of Wisconsin school districts which support high schools. This inquiry was made in order to discover the location of citizen committees in these school districts. Upon receipt of this information, a survey was conducted. Questionnaires were sent to chief school

administrators, presidents of boards of education, and lay citizens in the communities where committee activity was reported. As a result of this survey, 288 questionnaires were returned which contained useable data. A useable return of 61.2 percent was realized. These reports indicated that committees were active in 164 of the 432 Wisconsin school districts which support high schools.

For comparative purposes, the Wisconsin data were compared with those of two related studies, one by Lehmann, and the other by Hull. Furthermore, the Wisconsin data were compared with current theory on the subjects as revealed in the literature and by correspondence with authorities.

Findings and Conclusions

In Wisconsin, a large majority of the citizen committees were temporary committees. These committees were engaged in a variety of tasks. School building problems were commonly the concern of the committees. Permanent committees frequently ranged in size from 10 to 19 members. Temporary committees which ranged from five to nine members were most common. School authorities most frequently initiated committees. Committees were usually selected by boards of education. School administrators infrequently selected committees. Terms of office of committee members were most commonly indefinite in nature. Usually, members served until the committee assignment was completed. Most committees met irregularly with no predetermined schedule for meetings. Citizen committees commonly functioned in close supporting and advisory roles in their relation with boards of education and school administrators. School administrators frequently served in liaison roles between committees and boards of education. Most committees served as an effective means of communication between the school and the community. A high level of rapport and democratic interaction existed among the members of most committees. Committees usually incurred little or no expense in their operation.

In general, the findings of this study are consistent with the findings of Lehmann and Hull. Practices in Wisconsin are consistent with current theory on the topics in some respects and inconsistent in others.

Principles relating to the nature, purposes, structure, and operation of citizen committees are suggested as a result of this investigation. Several of these principles are briefly stated as follows:

1. School authorities should employ both permanent and temporary committees for the purpose of solving a variety of educational problems. Most problems are appropriate for responsible committees.
2. Committees should be initiated and sanctioned by boards of education and selected by responsible community agencies.
3. Committees should be large enough to represent the community, yet small enough to function effectively and to maintain a high level of rapport and democratic interaction among committee members.
4. School administrators should serve in liaison roles between committees and boards of education.
5. School administrators and instructional staffs when solicited should serve as consultants to committees.
6. Committees should serve school authorities in advisory and supporting roles and as effective means of communication between the school and the community.

Practices among citizen committees in Wisconsin are consistent with some of these principles and inconsistent with others. Microfilm $4.65; Xerox $15.60. 362 pages.

AN ANALYTICAL STUDY OF THE NEW YORK STATE RETIRED TEACHER WITH IMPLICATIONS FOR PRERETIREMENT COUNSELING

(L. C. Card No. Mic 58-3930)

Agnes L. Reilly, Ph.D.
The University of Connecticut, 1958

Problem. The study (1) examined the economic status of the New York State retired teacher; (2) analyzed special considerations for the teacher nearing retirement, reasons for retirement, and understanding of retirement laws; (3) recommended future actions that might improve vocational, financial, residential, and health adjustment to retirement.

Procedure. Through cooperation of the New York State Retired Teachers Association, 1,125 survey questionnaires were mailed to a random sampling of annuitants on the rolls of the New York State Retirement System as of July 1, 1956. From a 60.0 per cent response, 549 usable returns were categorized according to sex and service or disability retirement.

Findings. Among the major findings were:

1. Only one out of ten retirants felt that any special consideration had been given his approaching retirement.
2. Approximately two fifths of the teachers had retired because of poor health or disability. While New York State does not have compulsory retirement, 14.0 per cent of the retirants had been forced to retire because of age.
3. Only 12.8 per cent of the retirants had received preretirement counseling, yet most expressed need for such help in retirement planning and in money-management education principally with reference to taxation and legal aspects of personal finance.
4. Considerable need for better understanding of retirement laws was evidenced. Thirteen per cent of the men and 25.0 per cent of the women did not understand options; others were unaware that extra annuity might be purchased at retirement.
5. Three fifths of the group had sought re-employment, primarily from economic necessity, with major concentration in educational and in part-time work.
6. Detailed analysis of the economic status of retired teachers substantiated need for legislative action to raise the minimum retirement allowance of $108.50, which about half of the group was receiving.

7. The preponderance of single women (82.8 per cent), 46.1 per cent of whom lived alone, intensified the problem of residential adjustment, and perhaps accounted for 26.6 per cent of the retirants who professed an interest in living in a proposed New York State retired teachers' home.

8. Approximately one fifth of the group had no health insurance; others were financially pressed to maintain policies. There appeared to be a close correlation between health and satisfaction in retirement as well as between health and economic status.

Implications. To strengthen the economic status and facilitate adjustment for the New York State retired teacher:

1. Boards of education and administrators should (a) advocate and maintain professional salaries; (b) sponsor adult education courses, workshops, and other media for preretirement counseling; (c) acquaint teachers more thoroughly with changes in retirement laws; (d) investigate prepaid lifetime health insurance coverage; (e) explore tapering off and part-time employment for older teachers.

2. The Retirement Board should (a) improve facilities for teacher education on retirement laws; (b) endorse liberalization of retirement laws, wherever actuarially sound; (c) make its files available for research.

3. Present and retired teachers should (a) actively support legislation to supplement inadequate retirement allowances; (b) promote enabling legislation for more extensive part-time educational employment that will not endanger the retirement allowance; (c) aid in the development of retired teachers' homes adequate for state needs.

Microfilm $3.40; Xerox $11.60. 261 pages.

RECOMMENDED GUIDANCE STANDARDS FOR COMMISSIONED SECONDARY SCHOOLS OF INDIANA

(L. C. Card No. Mic 58-5214)

Bruce E. Shertzer, Ed.D.
Indiana University, 1958

Chairman: Howard T. Batchelder

The purpose of this study was to analyze the present guidance programs in the Indiana public secondary schools which had been classified by the Commission on General Education as continuous, first class, or special first class commissioned schools and to develop recommendations for guidance standards for each classification of commission. The basic hypothesis was that significant differences existed in the scope and provisions of the guidance programs of the different classifications of schools.

The Annual Report of the Guidance Program, an annual guidance report by secondary schools to the State Department of Public Instruction, was the chief source of data. From 269 schools were collected data relative to (1) organizational patterns of guidance, (2) services of the guidance program, (3) budget and physical facilities, (4) personnel of the guidance program, (5) recent and anticipated changes and problems of guidance, and (6) acceptance and attainment of certain basic principles of guidance.

Forty-six interviews were conducted, covering a 10 per cent random sampling of the schools in each classification of commission, in order to validate the data collected from the Annual Report. The data collected were compared through an empirical approach to the Evaluative Criteria, Form G, Guidance Services, as developed by the Cooperative Study of Secondary School Standards. Proposed recommendations for standards for each classification were drawn from an analysis of data and were submitted to a jury of eight experts composed of counselor-educators for an indication of their acceptance of each proposal. The jury of experts rated each proposed standard according to the following scale: (1) highly desirable, (2) desirable, (3) undesirable, or (4) highly undesirable.

Analysis of the results of the study revealed the following conclusions: (1) The Annual Report of the Guidance Program was a valid source of information; (2) in terms of student population there were more smaller schools classified as continuous commissioned schools than were classified as first class commissioned schools; (3) continuous commissioned schools generally made fewer provisions for the guidance program than did first class commissioned schools; (4) provisions for guidance services were less extensive in continuous commissioned schools than they were in first class commissioned schools; (5) continuous commissioned schools made fewer provisions for an adequate testing service than did first class commissioned schools; (6) fewer counseling services were provided in continuous commissioned schools than in first class commissioned schools; (7) placement and follow-up services were inadequately provided in all classifications of commissions; (8) physical facilities in guidance were less adequately provided in continuous commissioned schools than in first class commissioned schools; (9) continuous commissioned schools spent less money per pupil for the guidance program than did first class commissioned schools; (10) fewer guidance personnel were provided in continuous commissioned schools than in first class commissioned schools; (11) first class commissioned schools employed more trained counselors and provided more counseling time than did continuous commissioned schools; (12) not enough specialists were available in schools of either classification; (13) first class commissioned schools anticipated making greater provisions for the guidance program; and (14) lack of time, trained personnel, and finances were major problems in guidance for all schools and precluded satisfactory attainment of many of the principles of guidance.

Microfilm $3.70; Xerox $12.60. 288 pages.

A STUDY OF THE IDENTIFICATION, LOCAL PRE-SERVICE TRAINING, SELECTION, AND ORIENTATION OF ELEMENTARY SCHOOL PRINCIPALS IN SELECTED INDIANA SCHOOLS

(L. C. Card No. Mic 58-5217)

Howard A. Stapley Jr., Ed.D.
Indiana University, 1958

Chairman: Hanne J. Hicks

The purpose of this study was to discover and analyze some of the means by which individuals are locally identified, trained, selected for, and oriented to elementary school principalships in selected Indiana schools. A further facet of the investigation was to study the possible implications for colleges and universities preparing such personnel. An attempt has been made to determine whether or not there were distinguishing characteristics revealed by (1) the total number of elementary school principals employed per system, (2) the sources from which the new elementary school principals were obtained, and (3) the ratios of the number of new elementary school principals employed per system (since September 1, 1954) to the total number of elementary school principals currently employed per system.

The data were gathered through the use of a questionnaire and two interview guides designed especially for the investigation. The questionnaire was sent to 188 school superintendents. The superintendents' interview guide was used to gather information in 13 systems whose questionnaire returns had indicated that there were existing personnel practices in all four areas encompassed by the study, that at least one elementary school principal had been employed since September 1, 1954, and that permission had been granted by the chief school administrator for the researcher to visit the system. In the systems visited by the researcher, the interview guide for elementary school principals was utilized to gather information from the people who had been appointed to such positions since September 1, 1954. The 35 principals named by the superintendents and interviewed by the researcher comprised 85 per cent of the total number of elementary school principals appointed by the 13 systems since September 1, 1954.

Conclusions

From the findings in this investigation, based upon the responses of school superintendents and elementary school principals, the following conclusions are drawn:

1. The majority of systems do not have a program for identifying prospective elementary school principals.
2. Schools employing a larger number of principals tend to use a greater variety of identification techniques than do those employing fewer principals.
3. The administration does not tend to inform staff members when it is searching for prospective elementary principals in those systems visited by the researcher.
4. The majority of the systems providing local pre-service training to the prospective principals assign the trainees full-time teaching loads in addition to certain administrative responsibilities.
5. The training programs for prospective principals commonly include activities in pupil personnel, school organizations, and curriculum and instruction.
6. The systems tend to confine their search for principalship candidates to the state of Indiana.
7. Oral and written tests are the least popular means of selecting principals.
8. Systems with relatively high ratios of employment are using fewer people or groups in orienting their new elementary school principals than are systems with relatively low ratios of employment.
9. The most popular means of orienting new elementary school principals, in their order of mention, are informal discussion with the superintendents, administrative meetings, and faculty meetings.
10. The majority of the superintendents are uncertain as to whether or not institutions of higher learning could have initiated stronger screening programs for identifying prospective elementary school principals.

Microfilm $3.40; Xerox $11.60. 262 pages.

THE PUBLIC SCHOOL SUPERINTENDENCY IN THE STATE OF MAINE

(L. C. Card No. Mic 58-3934)

Raymond Dana Stinchfield, Ph.D.
The University of Connecticut, 1958

The major purpose of the study was to ascertain the professional status of superintendents of public schools in the State of Maine with particular emphasis upon their training, experience, professional and clerical assistance, and relationships with their school committees. This purpose was motivated by the belief that the future optimum development of the superintendency in Maine may well depend upon the collection of pertinent and significant data regarding the present status of Maine's superintendents.

The information in this study was supplied from data from the following sources: records, reports, and files of the State Department of Education, Augusta, Maine; office of the Dean, School of Education, University of Maine; Maine Directory of State School Officers for years 1945 through 1957; unpublished master's and doctor's theses dealing with public school superintendents; professional books and periodicals; and a questionnaire concerning administrative units, educational preparation, teaching and administrative experience, professional and clerical assistance, and superintendent-school committee relationships forwarded to every superintendent in Maine.

The findings indicate that, in general, Maine superintendents are experienced educators, their median years of school experience being 25.6 years. Eight out of ten hold master's degrees with two possessing earned doctor's degrees; none has less than a bachelor's degree. More than eighty per cent of the superintendents completed both their undergraduate and graduate preparation in Maine schools and colleges. Less than half of the superintendents have adequate clerical and professional assistance with the lack being most acute in the small rural administrative units. More than three-fourths of the superintendents report well defined relationships existing between themselves and their school committees.

The Maine State Department of Education should reassess its existing practice of serving as an employment bureau for school committees in search of a superintendent of schools. Without intent, it has dried up the vigor,

initiative and resourcefulness of local school committees' serious responsibility in seeking out the best qualified applicants for vacancies in the superintendent's office. The State Department of Education's responsibility should be restricted to passing upon the certification of candidates for the superintendency.

There is a tendency toward in-breeding in the Maine superintendency. As of July 1, 1957, more than eight out of ten superintendents received their undergraduate and graduate training in schools and colleges located within the State of Maine. Although Maine superintendents' insight and understanding of local educational problems may be greater as a result of the preponderance of Maine natives in the superintendency, there is the serious possibility that broad perspective and vision may give way to shortsighted provincialism.

The state, the governmental unit responsible for education in Maine, should restudy its system of administrative units. The large number of towns and school committees whom many superintendents serve make adequate administration and supervision of education very difficult.

The salaries of Maine superintendents are exceedingly low. They have failed to equal the legislated increases in teachers' salaries. The large turnover of superintendents indicates that the inducements are not sufficient to attract and retain the caliber of men and women required in this important position of educational leadership.

The School of Education, University of Maine, because of its status as the principal preparing institution for Maine superintendents, has a serious and continuing responsibility to provide both an undergraduate and graduate program which will meet the needs of present and prospective public school superintendents in Maine.

Microfilm $2.40; Xerox $8.40. 183 pages.

HAWAII'S PUBLIC SCHOOL PROGRAM FOR MENTALLY RETARDED CHILDREN

(L. C. Card No. Mic 58-5518)

Bluma Beryl Weiner, Ed.D.
University of Illinois, 1958

This field study was conducted in 1955-1957 during the investigator's term of appointment as Director of the Program for Mentally Retarded Children for the Department of Public Instruction of the Territory of Hawaii. The purpose of the study was to identify the nature and extent of the needs of the Territory in respect to the development of a comprehensive program of public school services for mentally retarded children and to devise or suggest means by which those needs might be met.

The procedures employed in problem-finding and problem-solving included (a) a review of the background of public education in Hawaii and of the growth of interest in provisions for mentally retarded children; (b) a survey of special educational and pupil guidance needs in the public schools of the Territory; (c) extensive field visits and conferences with instructional and administrative personnel in each of the five school districts of the Territory; and (d) cooperation with Department of Health agencies in services and special projects for mentally retarded children.

Although as early as 1908 there had been some acknowledgment by school officials of the problems presented by mentally retarded children in the public schools of the Territory, the first developments in special educational facilities were achieved not by school authorities but by a group of Honolulu club women who were concerned about the blind, deaf, and mentally defective children of school age who were receiving no instruction of any type. The School for Defectives established by this Women's Cooperative League was the forerunner of public facilities for handicapped children in Hawaii. A few classes for subnormal pupils were established in Honolulu during the 1920's, but there was no Territorial policy regarding the development of special curricula and no provision for professional guidance and direction nor for appropriate instructional facilities and materials. The growth of these classes was interrupted by the depression years of the 1930's and the war years of the 1940's.

Between 1949 and 1955 the Territorial Legislature enacted measures creating a Department of Special Education within the Department of Public Instruction and authorizing the establishment of pilot classes for educable mentally retarded children in the Honolulu District. In 1955 the amount of $100,000 was added to the school budget of the Territory for the specific purpose of extending and expanding the public school services for mentally retarded children.

The main problems identified by this study pertained to (a) clarification of terminologies and concepts; (b) establishment of criteria and procedures for admission to and transfer from special classes for educable and trainable mentally retarded children; (c) provision for necessary instructional facilities, equipment and supplies; (d) the need for school psychological services as part of the facilities of the Department of Public Instruction; and (e) the need for the establishment of special professional certification and opportunities for specialized training for the teachers employed in the program.

Although the study was concerned primarily with the improvement and expansion of special class facilities, it was recognized that for many years to come the majority of educable mentally retarded children would be enrolled in regular grade classrooms. It was therefore recommended that the concept of special services for these children should be extended to include provisions for all public school personnel to become better informed about and better able to work with the mentally retarded child who must remain in the regular classroom. Such an extended concept of special services was suggested as the most realistic means of reconciling the administration of universal public education with clinical knowledge of extreme differences in human intellectual endowment.

Microfilm $2.00; Xerox $6.20. 128 pages.

EDUCATION, ADULT

CHARACTERISTICS, TRAINING, AND PERFORMANCE OF HOUSEPARENTS IN RESIDENTIAL SCHOOLS FOR THE BLIND

(L. C. Card No. Mic 58-3950)

Everett Elliott Wilcox, Ed.D.
University of Oregon, 1958

Adviser: P. A. Killgallon

The purpose of this study was to identify the characteristics of houseparents, to determine the nature and extent of training available for them, and discover the factors that contribute to houseparent competency.

Three questionnaires were used to secure census-type information regarding houseparents and their conditions of employment. Opinions concerning the position were secured from houseparents and administrators. A fourth questionnaire was constructed to determine the preferred qualities in houseparent performance.

Data collected from 117 houseparents, 22 co-workers, 23 child-care authorities, and 36 administrators of residential schools through the use of the questionnaires were analyzed, and where possible, tabulated and interpreted.

The typical houseparent is a woman over 50 years of age who is often a widow. She has had less than 3 years of institutional experience and has completed twelve years of education. More houseparents are in the older age ranges than there were 15 years ago and children are under the care of persons who have an age level of their grandparents.

Although the contribution of the houseparent to the adjustment of the blind child is considered as important as that of the teacher, houseparent salaries are one-third less than that paid teachers and required qualifications for the position are lower than that expected of teachers. Houseparents are scheduled for longer hours of work than teachers and are required to supervise larger groups of children.

Supervision of houseparents is usually by the superintendent through irregularly scheduled conferences that are utilized for in-service training. Otherwise, administrators generally do not provide training courses.

Even though professional training is non-existent for houseparents and there are limited opportunities to gain needed experience before coming to the position, one-fourth of the houseparents credit themselves with enough training to meet job requirements. Generally, they wish to improve their skills but do not know how to proceed.

Houseparents need more information regarding the children placed in their care. Communication between the child's home and the residential school is usually one way because staff personnel do not visit the homes regularly. The houseparents are most frequently the representatives of the institution when the parents visit the child.

Houseparent co-workers and child-care authorities rated characteristic and performance items as to the contribution of each to the competency of houseparents. Through further study and refinement the preferred items might be utilized to evaluate houseparents or to screen applicants for employment.

The following recommendations for administrative policy were supported by the study:

1. Applicants for the houseparent position should have had at least 2 years of training beyond high school with courses in either education, counseling, recreation, or social work fields and should have the experience of rearing foster children. The position should be filled by emotionally stable persons who are from 25 to 64 years of age and are physically able to keep pace with the children.
2. The hours of duty required of the houseparent should be fewer than 50 each week; the number of children assigned to each houseparent should approximate the number assigned to each teacher; and the domestic tasks required of the houseparent should be reduced to a minimum.
3. To attract qualified applicants for the position, houseparent salary ranges should approximate that of teachers in the same locality.
4. Houseparent training programs should be initiated that will orient new personnel, encourage professional growth and develop techniques that work effectively with children in the residential school environment.

Inasmuch as many of the limitations imposed upon houseparents are within administrative purview, more intelligent planning can be instituted to improve the social environment of children in residential schools for the blind by utilizing the data reported in this study.

Microfilm $2.00; Xerox $6.60. 137 pages.

THE POSSIBLE ROLE OF ADULT EDUCATION IN DEVELOPING THE EGYPTIAN RURAL COMMUNITIES

(L. C. Card No. Mic 58-5223)

Elsayed Gamal Zaki, Ed.D.
Indiana University, 1958

Chairman: Paul Bergevin

Introduction

Egypt is a Moslem Middle Eastern country with an old cultural heritage. It suffered from invasions, despotic governments, and internal problems for the most part of its recent history. In the recent years the new government has been making efforts to solve the internal problems of the country. The major objectives of this endeavor are to promote a healthy democratic society, and raise the standards of living of the people. Many plans have been developed to achieve these objectives, some of which are under way. One of the means through which it is believed such objectives may be achieved is education.

Statement of the Problem

The problem which was selected to be investigated in this study is: What is the possible role of adult education in developing the Egyptian rural communities?

Procedure

The first task of this study was to investigate some aspects of the Egyptian society and their relationship to the problem. Of the various streams of the Egyptian culture, three major components were examined. These were politics, religion, and education. Each of these components was taken up in turn and examined in relation to the problem. While discussing the third, an emphasis was placed on the adult education movement in Egypt; its history, basic concepts, and practices. Two programs of community development which are under way in the country were also examined.

The second task of this study was to examine the role of adult education in community development programs in other countries. Three countries were selected for this purpose: the United States of America, Burma, and India.

The third task of this study was to review the Tahreer Project -- an experiment in planned communities which is under way in Egypt -- in which adult education is intensively utilized to establish and develop new communities.

The last undertaking was to analyse these different programs. From the results of this analysis suggestions and recommendations, relevant to the purpose of the study, were made.

Conclusions

The general conclusions of this study may be summarized as follows:

1. The historical development which transformed absolute rule into a democratic system did not completely take place in Egypt. Democracy was a strange system which was transplanted to a milieu unprepared for it and lacking the elements necessary for its maintenance and for its growth.
2. Due to the cultural contacts with the Western civilization a cultural gap has developed between urban and rural areas.
3. For the most part, adult education for rural areas is limited to abolishing illiteracy among the adult population.
4. Adult education in its broadest sense plays a vital part in the community development programs of the three selected countries.

Recommendations

A summary of the recommendations which seem most reasonable and justifiable is as follows:

1. Further studies and research are needed in these areas:
   a. Personality formation and development in the Egyptian socio-cultural milieu, as it is related to the field of adult education.
   b. Religion and its interpretation to fit into a pattern most suitable for the needs and demands of society and culture at present.
   c. The written word and its value as a mean of communication in rural areas.
2. Greater effort should be made to establish a sound adult education program for rural areas.
3. The Tahreer project experiment should be utilized as an experimental field for testing the validity of some of the general principles recommended in this study for establishing adult education programs for rural areas.
4. Professional work in adult education should be offered through institutions of higher learning.

Microfilm $4.25; Xerox $14.40. 331 pages.

EDUCATION, HISTORY

THE GROWTH AND DEVELOPMENT OF STATE TEACHERS COLLEGE, NEW PALTZ, STATE UNIVERSITY OF NEW YORK WITH IMPLICATIONS OF EDUCATION IN THE STATE OF NEW YORK

(L. C. Card No. Mic 58-3925)

Edward Lewis Klotzberger, Ph.D.
The University of Connecticut, 1958

The main purpose of the study was to make a critical search of materials to learn the true facts about the growth and development of the State Teachers College, New Paltz, State University of New York. The study was based on historical research and on interviews with individuals who had an active part in the College's growth and development. All events and forces that have made it an important educational institution have been included. The deeds and influences of prominent personalities constitute an essential part of this study, not mainly because the individuals themselves were important but because of their contribution to a more realistic understanding of the growth and development of the College and its involvement in education in the State.

The historical sources for this study were mainly: legislative acts, court decisions; minutes of boards, committees and councils; reports and orders of principals, superintendents, commissioners, directors and presidents; courses of study, catalogues, periodicals, newspapers, letters, contracts, yearbooks, files and records.

The study tells of the founding of the village of New Paltz, the settlers' early interest in education, the establishment of the New Paltz Classical School in 1828 and its progressive changes to an academy in 1833, a State Normal School in 1886, a State Teachers College with authority to grant the Bachelor's Degree in Education in 1942 and the Master's Degree in Education in 1947. An act of the New York State Legislature in 1948 created the State University of New York. Since the passage of this act, State Teachers College, New Paltz, has been a unit of the State University.

The change from a three year State Normal School to a State Teachers College brought a change in the curriculum with constantly increased emphasis on liberal cultural studies.

A program for the preparation of nursery school and kindergarten teachers leading to the early childhood education teaching certificate was established in November of 1945.

In accordance with action by the Trustees of the State University of New York the College was authorized, beginning in June, 1950, to grant the Bachelor's and Master's Degree of Science.

In addition to training elementary school teachers the College was authorized in 1951 to initiate a program for the training of art teachers for New York State elementary and secondary schools. In 1955 the program was further expanded when authorization was granted to prepare junior high school teachers in the areas of English, social studies, science and mathematics.

The liberal arts aspects of the curriculum have been strengthened until it is now possible to secure a major in an academic area in addition to the professional education major.

The rapid increase in enrolment in all college units of the State University of New York resulted in a need for a building program. In November, 1957, an amendment was passed authorizing a bond issue of $250,000,000 for the expansion of the State University of New York. From this sum $10,700,000 was designated for the College at New Paltz.

An appropriate combination of chronological and topical development proved most desirable. In each chronological period the interrelation between forces that influenced the administration, faculty, enrolment, courses of study, State Legislation and activity and other educational factors are presented.

All these developments indicate the influence that New Paltz has had on education in the State of New York. With the new program of expansion it is anticipated that the College will assume an increasingly greater role in the training of teachers and the advancement of public education.

Microfilm $4.00; Xerox $13.40. 310 pages.

EDUCATION, PSYCHOLOGY

A COMPARATIVE STUDY OF THE SELF-CONCEPT OF BEHAVIOR PROBLEM AND NON-BEHAVIOR PROBLEM HIGH SCHOOL BOYS

(L. C. Card No. Mic 58-5196)

Calvin O. Atchison, Ed.D.
Indiana University, 1958

Chairman: Grover T. Somers

The general purpose of this study was to compare self-concept ratings of two groups of high school boys who had been classified as behavior problems and non-behavior problems on the basis of teachers' ratings. The specific purposes were to compare these two groups of boys with regard to three dimensions of self and five frames of reference.

Using the Haggerty-Olson-Wickman Teacher Rating Schedule, three independent ratings were obtained on each ninth grade boy in order to differentiate two group boys; one behavior problem and one non-behavior problem. Ratings were obtained on 99 boys, and 78 were used in the study. Each boy rated himself using the Tennessee Department of Mental Health (TDMH) Self-Concept Scale.

It was hypothesized that non-behavior problem boys would have higher positive self-concept ratings; would be more clarity of their self concept than the behavior problem boys.

It was found that the non-behavior problem boys received significantly higher positive self-concept ratings than the behavior problem boys. There was no significant difference in consistency ratings of the two groups of boys. There was no significant difference in the clarity of self-concept ratings of the two groups of boys.

The writer concludes that school teachers might use self-concept ratings when dealing with overt, observable behavior problem boys in school in order to help understand the boy and plan a program to help him develop a positive concept of self. Since the behavior problem boy seems to have such clear understanding of how he feels about himself and seems so well satisfied with having a low positive self-concept, one major responsibility of the school is to arouse within the boy some dissatisfaction with his present self-concept by helping him reconstruct his value system.

Microfilm $2.00; Xerox $5.40. 109 pages.

PERCEPTIONS OF GUIDANCE SERVICES AS RELATED TO PERSONALITY NEEDS AND JOB TITLE

(L. C. Card No. Mic 58-5394)

Betty Jane Bosdell, Ph.D.
University of Illinois, 1958

The purpose of this study was to ascertain how selected groups of elementary school personnel assigned responsibility for guidance services, what they perceived as keeping them from performing these duties, and how job title and personality needs were related to their perceptions.

The sample consisted of 196 persons: 111 classroom teachers and 39 principals from five typical Illinois school districts, and 46 counselors from 24 districts. A questionnaire was developed to obtain information about guidance services and hindrances. The Edwards Personal Preference Schedule was used to measure personality needs.

Several areas of general agreement were found when the manner in which each job group assigned responsibility was analyzed. Counseling pupils concerning religious problems and providing vocational information were designated as "not the school's responsibility". Teachers were assigned responsibility for providing pupils with remedial instruction and special interest projects, for helping pupils develop a liking for school and for helping pupils discover their unique strengths and weaknesses. Principals were assigned responsibility for interpreting the school's services to parents, disciplining habitual offenders, and helping teachers with school problems. Counselors were assigned responsibility for counseling pupils with emotional and social problems. School psychologists were assigned responsibility for giving and interpreting individual or specialized tests. Where significant differences in the assignment of responsibility existed, each group often tended to assign responsibility for that service to themselves.

Significant differences on the hindrances generally involved the counselor responses. Principals and teachers more often than counselors checked as hindrances: unnecessary clerical duties, inadequate definition of guidance

responsibilities, feeling that other classroom duties had priority, and inadequate knowledge of tests. Counselors more so than teachers or principals felt the lack of communication among school personnel to be a hindrance. All three groups checked as hindrances: insufficient time for helping individual pupils and lack of sufficient guidance personnel.

Individuals with strong, average, and low need scores on each personality variable were identified. The only relationship that could not be accounted for by chance found teachers to be less nurturant and counselors and principals more nurturant than expected.

The mean score on the personality needs differentiated between the three groups. Teachers had a higher mean on order and a lower mean on exhibition. Counselors had a higher mean on succorance and nurturance and a lower mean on abasement. Principals had a higher mean on endurance and a lower mean on succorance. All groups tended to be more deferent and less autonomous and aggressive than Edwards' standardization group.

Responses of the need groups to the questionnaire were analyzed. The only general pattern of responses related to assignment of responsibility for services indicated that individuals with strong needs in exhibition, aggression, or change assigned the teacher responsibility for guidance services more frequently than individuals with lower needs in these areas.

Individuals with strong needs for affiliation, autonomy, or succorance tended to check as hindrances items reflecting a general feeling of inadequacy on the part of the individual checking the item. Individuals with order or change as strong needs or succorance as a low need tended to check as hindrances items which held someone other than themselves responsible or which pointed up inadequacies in the external situation.

Dominance, abasement, and endurance generally were not related to assignment of responsibility or designation of items as hindrances. Autonomy, succorance, or heterosexuality were generally not related to assignment of responsibility for guidance services; and achievement and intraception were not related to perception of hindrances.

The study indicated that job title, more so than personality needs, was related to the assignment of responsibility for guidance services and the designation of items as hindrances. Microfilm $2.00; Xerox $6.60. 136 pages.

A STUDY OF CHILDREN WITH CONTRASTING RECORDS OF SOCIAL ADJUSTMENT IN RELATION TO CERTAIN SCHOOL, HOME AND COMMUNITY FACTORS

(L. C. Card No. Mic 58-5199)

Jewell Brown Brownstein, Ed.D.
Indiana University, 1958

Chairman: Dr. Hanne Hicks

Problem: This study was made to determine the indicated differences between well adjusted and poorly adjusted pupils with respect to age, sex, I.Q., family position, mobility, promotion record, reading ability, and participation in out-of-school activities.

Procedure: The California Test of Personality was administered to the 682 sixth grade pupils in the New Albany-Floyd County School System. This was an attempt to get an objective evaluation of the social adjustment of all pupils.

A sociometric measure of pupils' choices was made in all sixth grade classes. These were interpreted in the light of the children who were most accepted and those most rejected in the class social structure. The children who were the most highly accepted were to become members of the well adjusted group; the children who were most highly rejected were to become members of the poorly adjusted group.

All sixth grade teachers were asked to rate the social adjustment of all their pupils on a data card provided.

Two groups were formed. Only those pupils whom all three measures (teacher's appraisal, pupil's appraisal and test) designated as well adjusted and poorly adjusted were included in these groups.

The children who became members of these two groups were given more detailed study. The writer attempted to study these particular pupils in light of their standing in the selected factors the study was considering. There was an effort to discover if these factors seemed to account for the particular group of which the child was considered a part of by his teacher, his classmates, and an objective measure.

On the basis of an interpretation of the collected data, the writer attempted to determine in a limited way the importance of these factors in the formation of social groups within the classes.

Conclusions: On the basis of the findings of this study, the following conclusions were drawn:

1. More boys than girls in the sample chosen for this study are considered to be poorly adjusted by their teachers and peers.
2. As far as the current study is concerned, age deviation from the norm of the group is an important factor in social adjustment.
3. There is no evidence to conclude that height and weight are specifically related to the social adjustment of the 52 subjects of this study.
4. The effect of the position in the family, as it could be measured, is negligible in relation to the social adjustment of the two groups studied.
5. In this investigation no evidence was discovered to suggest that the only child is handicapped in social situations.
6. A study of the home background of these boys and girls supported the assumption that the more stable the family is, the greater the opportunity for good social adjustment.
7. In general, poor readers operate at lower levels of social adjustment.
8. Emotional instability and social maladjustment may be a contributing factor to a reading deficiency, as well as the result of the handicap.
9. The study reveals that average or better than average intelligence seems to be an important factor in good social adjustment.
10. Mobility is a problem because students who move often appear to have more difficulty in adjusting socially.

Further research is needed regarding the identification, study, and guidance of poorly adjusted pupils in the crucial period of pre-adolescence.

Microfilm $2.00; Xerox $5.20. 104 pages.

THE TEMPORAL ORIENTATION OF THE FEMALE JUVENILE DELINQUENT

(L. C. Card No. Mic 58-3866)

Nancy Bess Farley, Ed.D.
The University of Oklahoma, 1958

Major Professor: Percy T. Teska

The purpose of this study was to investigate the temporal orientation of female juvenile delinquents in order to determine whether it differed from the temporal orientation of non-delinquent females, and to determine whether temporal orientation was more closely related to juvenile delinquency or to social class status.

A total of 160 subjects, 80 delinquents and 80 non-delinquents, were selected equally from the lower and middle social classes.

The delinquent population was selected from girls who had been adjudged delinquent by the Juvenile Courts and had been placed in the Girls' Training School at Tecumseh, Oklahoma, or at St. John's Vienney, Jenks, Oklahoma. The non-delinquent girls were selected from five of the junior-senior high schools in Oklahoma City. Subjects were matched as to chronological age, intelligence score, and social class status.

Each subject in an individual interview was asked to perform three tasks. These tasks were set up to determine general orientation on the three time variables: temporal direction, temporal span, and temporal fluency. Each subject, in response to the statement, "Tell me a story," and in response to six selected TAT cards, told seven stories.

The results of this study led to the following conclusions:

1. Delinquent and non-delinquent girls differed sharply in temporal orientation. Significant differences were found on all three variables, although the groups were confounded with the factor of social class.
2. Lower and middle social class girls differed in temporal orientation. Significant differences were found, although there were delinquents in both groups.
3. Lower and middle social class delinquents did not differ in temporal orientation. Delinquency was the common factor in these two groups.
4. Lower and middle social class non-delinquents differed in temporal orientation. Class status did make a difference in non-delinquents.
5. Middle social class delinquents and middle social class non-delinquents differed in temporal orientation. Delinquency was operating to account for the difference between these two groups.
6. Lower social class delinquents and lower social class non-delinquents differed somewhat in temporal orientation, although not as sharply as did the middle-class delinquents and non-delinquents.
7. Lower class non-delinquents, lower class delinquents, and middle class delinquents were similar in temporal orientation. There were common factors operating in these groups that made them homogeneous in respect to temporal orientation.
8. This study revealed a decided trend for the delinquents to live in the limited present.

Microfilm $2.00; Xerox $4.60. 87 pages.

A COMPARATIVE STUDY OF SELECTED FACTORS IN THE VOCATIONAL DEVELOPMENT OF INTELLECTUALLY SUPERIOR COLLEGE GIRLS FROM THE WORKING AND UPPER-CLASS LEVELS

(L. C. Card No. Mic 58-3913)

Louis Anthony Formica, Ph.D.
The University of Connecticut, 1958

Statement of the problem. This study has attempted to determine the role of socio-economic status in the vocational development of intellectually superior junior and senior college girls on the basis of the following selected factors: problem areas, marriage and career orientations, job security, job prestige and status, the emergence and persistence of occupational preferences and key figure influences.

Procedure. Fifty-six girls drawn from three New England colleges made up the total sample. Of this, a basic sample of fifteen upper-class and thirteen working-class girls was drawn from one school, a replicate sample of fifteen upper-class girls was drawn from a second school, and a replicate sample of thirteen working-class girls was drawn from a third school.

1. Each subject participated individually in an electrically recorded structured interview, and completed the Mooney Problem Check List and the Strong Vocational Interest Blank For Women.
2. Chi Square tests of significance were applied to the data from the Mooney List for each of the eleven problem areas, the total number of problems checked and the total number of "serious" problems checked. This method involved finding the median number of problems checked and the cases that fell above and below the median.
3. The Strong Blank data that were used consisted of A and B+ scores on the occupational scales with positive and negative male-association factor loadings. Chi Square tests of significance were applied to test for differences in the number of girls from each social class group who had received A and B+ scores, and in the number of A and B+ scores received by each group.
4. The recorded interview data were analyzed and pertinent materials were extracted and compiled into case summaries. The objectivity of the results of the extraction procedure was determined by the use of a second and third party. A rank-difference coefficient of correlation was computed.
5. The case summaries were rated by five judges as to the degree of marriage orientation and career orientation, the emphases placed on job security and job prestige and status, the time of emergence and persistence of occupational preferences, and the key figure influences.
6. After these statistics had been computed, the median of the average ranks was found for each of the six factors under study. Chi Square tests of significance were applied to test for the differences in the number of girls from each social class group whose average ranks fell above and below the median.

Findings.

1. Working-class girls had more problems on the Mooney List in Area II - Family, Living Conditions and Employment.
2. Working-class girls obtained more A and B+ scores on the Strong V.I.B. on those occupational scales designated

as career oriented, whereas upper-class girls obtained more A and B+ scores on the scales designated as marriage oriented. These findings were confirmed by an analysis of the judges' ratings.

3. The judges' ratings indicated that working-class girls placed more emphasis on job security.

4. The judges' ratings indicated that working-class girls had occupational preferences which emerged sooner and persisted longer.

5. The judges' ratings indicated that working-class girls were influenced more in their occupational preferences by extra-family key figures, whereas upper-class girls were influenced more by intra-family key figures.

6. No significant differences were found in the emphasis placed on job prestige and status.

Conclusions. The findings for this study indicate that the working-class girls significantly: had more problems in the area of Finances, Living Conditions and Employment, and had measured interests in more occupations designated as career-oriented. In addition, these girls were judged as significantly: more career-oriented, having placed more emphasis on job security, more influenced by extra-family key figures, and having had occupational preferences that emerged sooner and persisted longer. Upper-class girls significantly had measured interests in more occupations designated as marriage-oriented and were more influenced by intra-family key figures. No significant differences were found between the upper and working-class samples in the emphasis placed on job prestige and status. Microfilm $2.00; Xerox $7.00. 147 pages.

A STUDY OF CERTAIN AUTONOMIC PHYSIOLOGICAL REACTIONS OF SELECTED CHILDREN READING AT VARIOUS LEVELS OF DIFFICULTY

(Publication No. 24,216)

Elizabeth Frazier, Ed.D.
University of Missouri, 1957

Supervisor: A. Sterl Artley

Purpose: The purpose of this study was to record, evaluate, and compare the changes occurring in respiration rate, heart rate, galvanic skin response, and blood pressure of two groups of selected children while engaged in reading on different levels of reading difficulty.

Method of Research: The two groups of fifth and sixth grade pupils used as subjects were: (1) pupils reading one or more grades above the norm for their grade and who had a positive attitude toward reading and (2) pupils reading one or more grades below the norm for their grade and who had a negative attitude toward reading. Intelligence quotients of the subjects used were held within the range of 97 to 129. The four autonomic physiological responses of the subjects were recorded on a Keeler Polygraph while the subjects were reading paragraphs from Gray's Oral Reading Paragraph Test on their independent, instructional, and frustration levels of reading. In analyzing the data the following comparisons were made: (1) Comparison of the reactions in the pre-reading periods with the reactions in the reading periods of both the above-norm and below-norm groups respectively. (2) Intra-group comparisons in which the reactions of the subjects in the two groups (above-norm and below-norm) while reading on any given level of reading difficulty were compared with the reactions of the same group while reading on the other two levels of reading difficulty. (3) Inter-group comparisons in which reactions of the subjects in the above-norm group while reading on the three levels of reading difficulty were compared with the reactions of the subjects in the below-norm group while reading on the three levels.

Conclusions:

(1) To the extent to which changes in the autonomic physiological reactions measured in this study are indices of emotion, we can assume that the act of reading does evoke an emotional reaction among children of both above-norm and below-norm reading achievement on all levels of reading difficulty.

(2) Although all levels of reading difficulty caused changes in respiration rate, heart rate, galvanic skin resistance, and blood pressure, the frustration level of reading difficulty was responsible for the most significant changes measured in the four autonomic physiological reactions.

(3) In the majority of responses measured, the frustration level of reading was responsible for reactions of greater intensity among the below-norm readers than among the above-norm readers.

(4) Heart rate appeared to be more affected by the act of reading than did respiration and galvanic skin response in both above-norm and below-norm groups reading on all levels of difficulty.

(5) The act of reading on all three levels of difficulty was accompanied by a decrease in respiration rate and galvanic skin response, an increase in heart rate, and a "rising trend" in blood pressure.

(6) The difficulty of the reading material appeared to be more responsible for differential changes in the autonomic physiological reactions measured in this study than did the reading ability of the subjects.

Microfilm $2.00; Xerox $5.60. 113 pages. Mic 58-5067.

REALISM AND CONSISTENCY IN EARLY ADOLESCENT ASPIRATIONS AND EXPECTATIONS

(L. C. Card No. Mic 58-2588)

Martin Hamburger, Ph.D.
Columbia University, 1958

The problem of realism was examined as an aspect of the changing nature of adolescence in twentieth century America. The facts of prolonged dependency and diminished opportunity for reality testing were considered along with some assumptions about adolescent potential. It was assumed that the early adolescent has the capacity for greater self-understanding and for more intelligent planning than is customarily accepted. The absence of suitable opportunities for using this potential was suggested as one reason for the exploratory period emerging as an age of confusion. The notion that adolescent planning is

unrealistic because aspirations far exceed opportunities has been supported by most prior research. The design for the present study adopted the frequently used criteria of intelligence and socioeconomic status together with the less precisely defined, but nonetheless frequently used criterion of occupational opportunities. Operationally-defined aspirations (elicited by encouraging fantasy) and expectations (reality-oriented) in vocational, educational, and other aspects of life planning were obtained from a group of ninth-grade boys. The planning variables were intercorrelated with each other and with the status variables of intelligence and socioeconomic status. In addition, qualitative analysis was made of the boys' plans in comparison with current opportunities and projected manpower needs.

It was hypothesized that plans would be significantly related to the criterion variables. It was further hypothesized that there would be greater degrees of realism in the expectations than in the aspirations. Finally, on the assumption that consistency is an important corollary of realism, it was hypothesized that significant intercorrelations would exist among the aspirations and among the expectations.

The results showed that the vocational and vocationally-related plans were significantly related to socioeconomic status and to intelligence, with intelligence apparently the more important of these two variables. The general planning variables (such as desired age of marriage and number of children) showed practically no relationship to the status variables. There were no significant differences between aspirations and expectations in relation to intelligence and social status. Highly significant intercorrelations among the vocational and vocationally-related aspirations as well as among the expectations emerged, but no such internal consistency was found among the general planning variables.

Qualitative analysis showed evidence of considerable realism in that the boys' plans conformed to projected occupational opportunities. However the range of vocational preferences was limited as to both level and kind. Along with the statistical findings, the qualitative analysis suggested that there was a certain degree of mobility desired, but that this was lower than might be expected when fantasy is encouraged.

The implications of these findings were defined within the boundaries of the study. Suggestions for research and implications for theory and practice were indicated.

Microfilm $2.00; Xerox $5.40. 109 pages.

CONCEPT OF SELF AS A VARIABLE IN ADOLESCENT BEHAVIOR

(L. C. Card No. Mic 58-5104)

Travis Leon Hawk, Ed.D.
The University of Texas, 1958

Supervisor: Dr. Carson McGuire

The research was designed to test propositions about the manner in which prior and current experiences influence the concepts of self held by adolescents. Sample populations differing in sex role, family life style, peer affiliation, age-mate role assignments, and degree of perceived self-ideal self discrepancy or ego discrepancy were expected to reflect variations in self representations arising out of past and current experiences. Self representations of 123 adolescent boys and girls were elicited through responses to 32 self referent items contained in a structured Q-sample. Embodied in the Q-sample were the four dimensions of referring to one's self; namely, self concept (I am...), role behavior (I do...), interpersonal competence (I relate to...), and social control (I ought to...). Through the same responses, each subject characterized his or her self with regard to four kinds of psychological orientations; namely, intensional (personal), dependence (authority), extensional (reality), and ambivalence (conflict). When the four categories of dimensions were combined with the four psychological orientations, there were 16 subgroups of items, each with two replications.

The 123 adolescent boys and girls comprised the sample population from which samples could be drawn to represent the two sex roles (male and female), three social classes (upper middle, lower middle, and lower class), two kinds of peer affiliation (positive and negative), seven age-mate role assignments ("wheel," "brain," "average-one," "mouse," "outcast," "drip," and "isolate"), and three kinds of ego discrepancy (low, medium, and high). Subsamples of subjects were drawn from the sample for testing each of the hypotheses in a specific analysis of variance design.

Some significant main effects or interactions were obtained for each population variable. The analysis of data tended to support the original proposition by demonstrating that significant differences in self representations existed between certain subsamples of subjects in the sample population. Consistently, boys expressed their relative independence and certainty compared with girls and their representations. On the other hand, girls characteristically expressed a greater dependence upon those in authority.

The findings indicated not only that one's concept of self depended upon whether one was a boy or girl but also whether he came from a lower class or middle class family as well as being accepted or avoided by his age-mates. The findings suggested that experiences as a boy or girl and in peer affiliation modify the influences of family life style in self representations.

Boys and girls who saw themselves essentially as they would like to be expressed a higher degree of self confidence and less uncertainty about themselves than did the subjects whose ego discrepancies were medium and high. Those subjects whose ego discrepancies were medium and high described themselves in a manner that made them similar to one another.

The foregoing findings suggest that the self concept is an important variable in adolescent behavior. If school people are to understand adolescent behavior, they need to begin by examining the manner in which the adolescent views himself. Microfilm $2.00; Xerox $6.40. 135 pages.

LEADERSHIP BEHAVIOR IN INDEPENDENT AND FRATERNITY HOUSES

(L. C. Card No. Mic 58-5436)

Richard Earle Hulet, Ed.D.
University of Illinois, 1958

Leadership has been studied in many ways. Early attempts sought to find the qualities of leadership, and this aspect continues today as important to many writers. Recent writings have given more attention to the relational aspects between leaders and groups.

This research is an attempt to study leadership in campus group living situations as perceived by leaders and members of fraternity, independent and dormitory houses.

At the University of Illinois, a questionnaire of 66 items was administered to the presidents and two seniors in each fraternity, independent house, and dormitory having 25 or more members. The following hypotheses were tested:

1. There are differences between members' perceptions of good leaders' behavior in fraternities, members' perceptions of good leaders' behavior in organized independent houses and members' perceptions of good leaders' behavior in university men's dormitories at the University of Illinois.
2. There are differences between leaders' perceptions of good leaders' behavior in fraternities, leaders' perceptions of good leaders' behavior in organized independent houses and leaders' perceptions of good leaders' behavior in university men's dormitories at the University of Illinois.
3. There are differences between members' perceptions of good members' leadership behavior in fraternities, members' perceptions of good members' leadership behavior in organized independent houses and members' perceptions of good members' leadership behavior in university men's dormitories at the University of Illinois.
4. There are differences between leaders' perceptions of good members' leadership behavior in fraternities, leaders' perceptions of good members' leadership behavior in organized independent houses and leaders' perceptions of good members' leadership behavior in university men's dormitories at the University of Illinois.

The results of the questionnaire were treated so that the answers to each question were considered significant if one or two categories collected responses equal to or greater than two standard errors above the mean. Each question on the instrument could be answered: "Really describes," "Sometimes describes," "Seldom describes," "Never describes," "Uncertain," or "Does not apply," depending upon perceptions of a good president or member of the house. The responses were compared between the three groups and the results supported all four hypotheses.

We may say from the results of the study that fraternity, independent, and dormitory members at the University, see their presidents more nearly alike than do their presidents. It may be inferred that fraternity members and presidents perceive their leaders as being more dominating than the other groups. It would seem to be more important for fraternity and independent house presidents not to be cliquish than it does for the dormitory presidents. A rather unexpected reaction to a question on religious convictions was noted. Fraternity presidents and members perceived their leaders as having religious convictions while dormitory members and presidents and independent house members answered in a manner not considered significant. In addition, responses to a number of questions indicated that leadership behavior on the part of members of these groups is perceived somewhat differently than that of the presidents. The presidents were perceived as putting the good of the house ahead of their personal needs while the members were not so perceived.

The field to which we have given our attention needs further study. This research has only scratched the surface. Many questions need to be answered. Are the value systems of the three groups different? Are the presidents the real leaders of the houses? Is leadership a function of the nature of the house, the situation at the moment or the characteristics of the individual or individuals involved -- or combinations of all three?

Microfilm $2.00; Xerox $4.80. 92 pages.

A COMPARISON OF RETARDED AND NORMAL CHILDREN WITH RESPECT TO ALEXANDER'S "F" FACTOR

(L. C. Card No. Mic 58-3946)

Calvin Clayton Nelson, Ph.D.
University of Oregon, 1958

Adviser: Bert Y. Kersh

The purpose of this study was to compare retarded and normal children in terms of practical ability. Two measures of practical ability were employed. The primary measure was the Alexander Performance Scale which was designed to measure practical ability. The second measure was the ratings of practical behavior about the school assigned by the child's teacher. A special rating sheet was developed for the purpose of recording observations of this behavior.

Mental retardation and average (normal) intelligence were defined in statistical terms. Children were tested with the Wechsler Intelligence Scale for Children (to be referred to hereafter as the WISC). If a child's WISC IQ was between the limits of 60 and 80, he was regarded as retarded. If the child had an IQ between the limits of 90 and 110, he was considered to be of average mental development.

The subjects were divided into two groups of thirty. Thirty children were retarded and thirty children were normal. There were fifteen boys and fifteen girls in each group. The mean IQ of the retarded group was 72.00 and the mean IQ of the normal group was 104.00.

Each child in the retarded group was matched with a child of the same sex in the normal group in terms of WISC raw scores. The criterion of matching was that the WISC raw scores of the two children be within ten points of one another.

All children were given the Alexander Performance Scale. In addition, each child was rated by his classroom teacher in terms of practical behavior about the school.

Two hypotheses were tested regarding the performance of the two groups of subjects on the Alexander Performance Scale. The first of these stated that retarded children do not differ from normal children in terms of Alexander Performance Scale raw scores when matched on the basis of WISC raw scores. The second hypothesis stated that children who are retarded do not differ from normal children in terms of Alexander Performance Scale raw scores when differences in chronological age were controlled. These hypotheses were tested by means of testing the "F" ratios derived from two analysis of covariance designs. The first hypothesis was accepted whereas the second was rejected. This is taken to mean that subjects perform approximately the same on both tests. Children who have higher WISC scores tend to have higher Alexander Performance Scale scores.

Estimates of practical behavior about the school were made by classroom teachers using a rating sheet developed for this purpose. The internal consistency of the rating sheet and the reliability of the ratings were estimated. The internal consistency of the rating sheet was estimated by the split-half method of computing reliability. The reliability of each rater's estimates and the extent of agreement between raters were arrived at by means of computing mean square contingency coefficients. The reliabilities of the ratings made by individual teachers were moderately high. The agreement between teachers was moderately low.

The relationship between each item on the rating sheet and Alexander Performance Scale scores was estimated by means of computing product-moment correlation coefficients. Ratings obtained for each item were correlated with the subject's standing in the upper or lower twenty-seven per cent of the Alexander Scale PAR distribution. Eighteen of the forty-five items of rating sheet correlated .26 or higher with Alexander Performance Scale scores. All correlations were positive or zero except three.

The overall ratings of the subjects were correlated with Alexander Performance Scale PARs and WISC IQs. These relationships were stated in terms of phi coefficients. Both relationships were positive and significantly different from zero. The relationship between WISC IQs and ratings on the practicality rating sheet was much higher than that between the Alexander Performance Scale PARs and the ratings. Microfilm $2.00; Xerox $6.40. 134 pages.

COMPARISON OF PERFORMANCE OF COMPETENT AND INCOMPETENT READERS IN A STATE TRAINING SCHOOL FOR DELINQUENT BOYS ON THE WAIS AND THE ROSENZWEIG P-F STUDY

(L. C. Card No. Mic 58-3947)

Glen A. Purdom, Jr., Ed.D.
University of Oregon, 1958

Adviser: P. A. Killgallon

Four standardized examinations--the Wechsler Adult Intelligence Scale (WAIS), the Cooperative Reading Comprehension test, the Rosenzweig Picture-Frustration Study (P-F), and the Minnesota Multiphasic Personality Inventory (MMPI)--were administered to 97 inmates aged 16 through 17 years of the Oregon state residential facility for adjudicated delinquent wards of the court (MacLaren School for Boys). Of primary concern was the response of incompetent readers to the WAIS (a revision and restandardization of the Wechsler-Bellevue Intelligence Scale) and the adult form of the P-F Study. Secondary emphasis was placed on analysis and description of the delinquent group in terms of the measures employed.

Sixty-two of the total sample population of 97 boys were found to be incompetent readers; that is, they scored below one standard deviation below the mean percentile of their normally expected reading level. As a group the incompetent readers scored within the normal range on the WAIS with mean I.Q.'s as follows: Verbal 97.9, Performance 101.8, Full Scale 100.1. The competent reader group also scored within the normal range on the WAIS; however, mean Verbal, Performance and Full Scale scores were higher for this group than for the incompetent readers to the extent that difference between respective means was statistically significant.

Rank order profiles of WAIS results of the competent and incompetent reader groups were very similar. For both groups Comprehension and Similarities ranked high, Information ranked low. The only difference on the Verbal scale was depressed Vocabulary and higher Digit Span for the incompetent reader group. Performance rank order also showed much similarity with high ranking Picture Arrangement and Picture Completion, low ranking Digit Symbol.

On the P-F Study the total MacLaren group scored high on Need Persistance, low on Obstacle-Dominance and Group Conformity Rating. Differences between these means and those of the P-F standardization group are statistically significant. The incompetent readers scored in a manner identical to that of the total group on the P-F. Competent readers scored similarly in these three categories, but not to the extent of statistical significance of difference between means. The competent readers also scored quite high on the Extrapunitive and Ego-Defense scales. In a comparison of results of the competent and incompetent readers on the P-F differences between means was not significant in any of the seven scoring categories.

Results on the MMPI indicated a preponderance of abnormally high scores on the Psychopathic Deviate and Hypomania scales. Both competent and incompetent reader groups scored in this manner, with a higher per cent of the competent readers so scoring. The difference between means of the two reading groups, however, was not statistically significant.

From the data of the study certain conclusions about this sample population appear to be valid. Incompetent readers as a group do not present a typical pattern of responses to the WAIS subtests that is substantially different from that of competent readers. Incompetent readers do score significantly higher on Performance as opposed to Verbal subtests. They score significantly lower on Verbal, Performance and Full Scale than do competent readers. Results of personality measures do not show significant differences between competent and incompetent readers.

As a whole the MacLaren sample population may be described within the limits of the measuring instruments employed in this study as a group of intellectually average youth, two-thirds of whom are retarded in reading, and who can be described as socially irresponsible, pronouncedly aggressive, ego-defensive, lacking strong emotional attachments and low in frustration tolerance.

Differences between the data of this study and findings of research into related problems may be influenced by the institutional population, direct comparison of incompetent with competent reader groups, and definition of reading inability. Microfilm $2.15; Xerox $7.60. 161 pages.

A STUDY OF CEREBRAL PALSY IN TEXAS

(L. C. Card No. Mic 58-3999)

Lawrence Leon Reid, Ph.D.
The University of Texas, 1958

Supervisor: Dr. William G. Wolfe

A registry of 5,618 cerebral palsied individuals representative of the ethnic classifications found in the State of Texas was established through the cooperation of physicians, cerebral palsy treatment centers, hospitals, Crippled Children's Division of the State Department of Health, Vocational Rehabilitation Division of the Texas Education Agency, schools, agencies, and other individuals. The questionnaire and interview techniques were used to obtain the information related to the following ten significant aspects of the problem of cerebral palsy selected for this study: (1) the incidence and prevalence of cerebral palsy in the State of Texas, (2) the prevalence of the types of cerebral palsy and the severity of involvement for each case, (3) the frequency of certain possible etiological factors, (4) the frequency of certain other medical factors, (5) developmental patterns common to cerebral palsied individuals, (6) the educational background and experiences of the cerebral palsied, (7) the nature of the treatment and care of the cerebral palsied, (8) the occupations the cerebral palsied are following, (9) factors determining the social status and value orientations of the cerebral palsied person's family, and (10) the parents' opinions concerning their cerebral palsied children.

The results of the study are presented in four Sections: Section I, the data concerned with the total number of cerebral palsied persons with known addresses (N=5,618); Section II, the data concerning the 3,692 who completed the one page, check type questionnaire after the initial contact; Section III, the data concerned with the 2,408 cases for whom an extensive case history was obtained; and Section IV, the data concerning parental opinions (N=1,753).

This research is of particular interest to the professional worker, student, and lay individual concerned with the problems of cerebral palsy. The data obtained concerning the ten general aspects of this study should be of particular value to the administrator, the counselor, the physician, the parents of cerebral palsied persons, the student, and the researcher.

Microfilm $5.05; Xerox $17.00. 395 pages.

THE EFFECT OF SYLLABIFIED PRINT ON FOUR ASPECTS OF READING

(L. C. Card No. Mic 58-5213)

Gordon Howard Rettke, Ed.D.
Indiana University, 1958

Chairman: William W. Lynch, Jr.

Problem: To determine if syllabified print aids word pronunciation, and if it tends to inhibit reading as a thought-getting process.

Procedure: The experiment in this study employed commercially published tests of reading achievement to measure word pronunciation, vocabulary, comprehension, and speed. Except for the word pronunciation test, comparable forms of these tests were reproduced in both standard and syllabified print by means of an I.B.M. Executive typewriter and the multilith process. The tests were administered to 90 children in the intermediate grades. One half of the group took Experimental Form I followed by Control Form II, and the other half took Control Form I followed by Experimental Form II. The single form word pronunciation test was administered individually with an alternating sequence of the experimental and control copies. The statistical formula of t for paired groups was used to test the significance of the difference between the various experimental and control means. The .05 level of confidence was required for significance.

Findings: The mean difference in word pronunciation for the total group was highly significant and favored the syllabified print. The mean differences for vocabulary and speed were positive but small and not significant. The mean difference for comprehension was small but negative and not significant statistically.

Grade levels. The mean differences in word pronunciation favored syllabified print at each grade. These differences were highly significant statistically for fifth and sixth graders but were not significant for fourth graders.

The mean differences in vocabulary, though slightly negative for fourth and fifth graders, tended in the direction of favorability toward the experimental print at the higher grades. None reached statistical significance.

The mean differences in comprehension were slightly negative for each grade. None reached statistical significance.

The mean differences in speed were slightly negative for fourth and sixth graders but moderately positive for fifth graders. None reached significance statistically.

Good and poor achievers. The good and poor achievers showed mean differences for each skill, excepting word pronunciation, which were diametrically opposed. The good achievers favored the standard print, and the poor achievers almost equally favored the syllabified print.

In the case of word pronunciation, both the good and poor achievers showed significant differences favoring syllabified print.

The mean differences for the good achievers in vocabulary, comprehension, and speed were significant and favored standard print. Conversely, the mean differences for the poor achievers in vocabulary and speed were significant and favored syllabified print. The poor achievers favored syllabified print in comprehension as well, but the difference was not significant statistically.

Conclusions: These concluding statements pertain only to the population of the experiment within the limitations of the study.

1. Does syllabified print aid word pronunciation in reading? The answer is a very definite yes. The syllabified print used in this study aided word pronunciation for the total group, for the good achievers, for the poor achievers, for the 6th graders, and for the 5th graders. It failed to produce significant results only in the case of the 4th grade group.

2. Does syllabified print deter the thought-getting process in reading? The answer is yes and no. The syllabified print used in this study had the effect of lowering the scores of good achievers in tests of vocabulary, comprehension, and speed. However, it raised the scores of poor achievers in tests of vocabulary and speed. Its effect on the results of the various tests was not statistically significant for the total group or for the 4th, 5th, and 6th grade sub-groups. Microfilm $2.75; Xerox $9.40. 210 pages.

AN EVALUATION OF STUDENT PERSONNEL SERVICES AT MARION COLLEGE

(L. C. Card No. Mic 58-5215)

E. Harold Shigley, Ed.D.
Indiana University, 1958

Chairman: Dr. Robert H. Shaffer

Problem: The purpose of this study was to make an evaluative study of the quantitative and qualitative aspects of the program of student personnel services in terms of student and faculty opinions of the adequacies and inadequacies of various areas of these services and to derive conclusions from the findings which would bring about a better organized and more functional program.

Procedure: Kamm and Wrenn's An Inventory of Student Personnel Services was adapted for use in obtaining opinions of students and revised for use in obtaining opinions of the faculty. These companion instruments contained 70 matched items covering the following 12 areas of student personnel services: Recruitment and Admissions, New Student Orientation, Counseling Services, Health Services, Student Housing, Food Services, Extra-Class Activities, Adjustment of Institutional Program to Student Needs, Student Financial Aids and Part-time Employment, Placement Services, Student Personnel Records, and Guidance in Student Conduct.

The personal interview technique was used with all faculty members and a 25 per cent random sample of students from each college class of the institution, in the Spring Quarter of 1957, for the purpose of obtaining the data for this study. There were 27 faculty members and 95 students included in the study. Student responses were analyzed and comparisons were made according to class, department, sex, marital status, employment status, entrance status, church affiliation, and academic ability. Faculty responses were analyzed and comparisons were made according to position or assignment, sex, tenure, experience, and age of respondents. Comparisons of student and faculty responses were made and the chi square test was used to determine significant differences between the responses of the various paired groups according to the factors mentioned above.

Findings: (1) The program as a whole was rated as inadequate by both student and faculty respondents while some areas of services were rated as adequate and some as inadequate by each group. (2) Three of the 12 areas of services were rated as adequate by the student respondents and two areas were rated as adequate by the faculty. (3) Both student and faculty respondents indicated they had sufficient information relative to five areas and that they needed more information on the other seven areas of student personnel services. (4) Significant differences were found between the responses of faculty and students, between divergent faculty groups, and between divergent student groups, relative to their knowledge and opinions of adequacy of various services. (5) Greater differences were found between the responses of divergent student groups and between the responses of divergent faculty groups than were found between the responses of students and faculty.

Conclusions: According to the criteria used, an appraisal of the findings led to a number of conclusions including the following: (1) The student personnel program as a whole was inadequate. (2) Certain areas of the program needed special attention, especially student placement services, student aids, and guidance in student conduct. (3) Certain student and faculty groups needed special attention, especially working students and new faculty members. (4) The student personnel services which were available had not been adequately communicated to faculty and students. (5) Lack of information disclosed by both faculty and student respondents was more apparent in those areas where there had been least opportunity for direct contact. (6) Those faculty members who were in a position to do most about making improvements in the services were more satisfied than others with the present program.
Microfilm $3.15; Xerox $10.80. 244 pages.

AGE-MATE ASSESSMENTS IN EARLY ADOLESCENCE

(L. C. Card No. Mic 58-5105)

John William Skinner, Ed.D.
The University of Texas, 1958

Supervisor: Dr. Carson McGuire

The life-setting research is designed to add to the growing wealth of information about adolescents' perceptions and evaluations of one another and to give some insight into their evaluations of certain attributes. The plan of the present inquiry has been to organize selection and nomination data so as to study certain attributes pertinent to roles and values in an early adolescent society. The attributes employed are identical with those used by Tryon and associates in a study of adolescent personality in California. The population sample in the present inquiry differs from that of the original study in that it contains a higher percentage of adolescents from lower status homes and also contains a higher percentage of boys and girls from ethnic backgrounds.

The hypotheses are two in number. The first proposes that, regardless of scholastic achievement or family life style, the assessments of attributes to adolescents vary with the peer acceptance of the subjects. The second proposition is complementary to the first and proposes that selection of preferred attributes varies with peer status, school achievement, family status, and/or sex role of the informants.

Sources of variation have been examined in students' perception of their peers as well as their evaluations of attributes and roles assigned to one another. The sample population employed in studying perception of peers contains 90 subjects drawn to represent differences in family life style, peer acceptance, and relative school achievement. The same population variables with the addition of sex role are employed with a sample of 148 teen-agers in examining sources of variation in attribute selections.

In general, the adolescents agree that the 11 attributes which deal with social manner and social status are characteristics which are preferable in one's friends. There is also general agreement that six of the seven attributes which deal with aggression are not preferable character traits. Specifically, however, the second hypothesis is discredited. No variation significant at the one or five per cent points is revealed from selections of adolescents with varying levels of peer acceptance. Only selections of Older friends as opposed to younger friends is found to vary according to the sex role of the informant. Differences in selections of boys and girls of varying family styles are found to vary in selections of Restless not quiet, Humor-self versus humorless-self, and Friendly as opposed to unfriendly. The population variable providing the greatest number of attributes with significant variation in selection is relative school achievement. Restless not quiet, Talkative as opposed to silent, Unkempt not tidy, Fights versus avoiding fighting, and Good-looking as opposed to being not good-looking are significantly different when the selections of high, average, and low achievers are studied.

The first hypothesis is partially sustained and partially discredited by analysis procedure. Peer acceptance, measured by an index of peer status, appears as an independent variable in 9 of 20 sets of nomination data. Positively valued boys and girls are regarded by their peers as neat, as avoidant of fights, as leaders, as active in games, as popular, as friendly, as good-looking, as enthusiastic, and as happy. Peer status also combines with family background and/or relative school achievement to explain some nomination variance for six other sets of nomination data.

In addition to zero order coefficients and analyses of variance, the present inquiry employs intra-class correlations, termed coefficients of resemblance, to help explain sources of reputation variance. Curvilinear relationships are particularly noticable when the triple interaction of the three main effects are studied. In each instance where significant relationship, not revealed by zero order correlation, is revealed by the resemblance coefficients the extreme groups are found to be more similar than consecutive groups in a continuum.

Microfilm $2.25; Xerox $7.80. 170 pages.

PERSONALITY CHARACTERISTICS OF RURAL AND URBAN SOUTHERN NEGRO CHILDREN

(L. C. Card No. Mic 58-5216)

Paul Milton Smith, Jr., Ed.D.
Indiana University, 1958

Chairman: Dr. H. Robert Kinker

Statement of the Problem

This study involved an examination of the personality characteristics of Southern rural and urban Negro children for the purpose of determining if there were differences between the two groups; and to determine whether special guidance and counseling services were necessary for such students.

Methods of Procedure

A 30 per cent random sample consisting of 150 junior and senior class students in rural and urban schools comprised the subjects of this study. The data were obtained by administering (1) a personal data questionnaire, (2) the Otis Quick-Scoring Mental Ability Tests, (3) the California Test of Personality, (4) The Mooney Problem Checklist, and (5) by computing grade point averages.

The statistical methods used to treat the data were (1) the computation of certain measures of central tendency and variability, (2) linear correlations, and (3) certain tests of significance: (a) a chi square test of equally-distributed frequencies, and normality of distributions, and (b) the t-ratio test for significance of difference between group means. The null hypothesis was assumed and tested for significance at the one and five per cent levels. The statistical treatment applied to personal data from the questionnaires was the number and per cent of occurrences.

Findings and Conclusions

1. Rural and urban students appeared to be very much alike with respect to general characteristics, adjustments made to home and school, and socio-economic status. Urban students, however, seemed to come from homes of slightly higher socio-economic status, and they had a higher educational status than did rural students.
2. Urban students were significantly higher in intelligence test scores than were rural students. This suggested that urban students were superior to rural students in intelligence.
3. With respect to the sex aspect, there appeared to be no significant difference between the mean intelligence test scores of boys and that of girls.
4. Rural students were significantly higher in grade point average than were urban students. This suggested that rural students were superior to urban students in academic achievement.
5. There appeared to be no significant difference in academic achievement between boys and girls.
6. Neither was there any significant difference between rural and urban boys and girls with respect to personal, social, and total adjustment.

Both groups of students showed poor adjustment tendencies in a sense of personal freedom, withdrawing tendencies, anti-social tendencies, family relations, and school relations.

7. Urban students had significantly more problems

than did rural students, and girls had significantly more problems than did boys.

Rural students appeared to be more concerned with problems of finances, living conditions, and employment; adjustment to school work, and the future: vocational and educational, while urban students appeared to be more concerned with problems of adjustment to school work; curriculum and teaching procedure, and personal-psychological relations.

Rural students were concerned least with problems associated with curriculum and teaching procedure, while urban students were concerned least with problems associated with home and family.

8. The highest correlations obtained were between intelligence and academic achievement, .60 for rural students and .68 for urban students.

There appeared to be some evidence for suggesting that guidance provisions and services be enriched and intensified, but no evidence appeared for suggesting that guidance services be different for Negro students attending rural and urban schools than that expected for any other students.

Microfilm $2.95; Xerox $10.20. 226 pages.

A COMPARISON OF THE SOCIAL STATUS OF MENTALLY RETARDED CHILDREN ENROLLED IN SPECIAL CLASSES

(L. C. Card No. Mic 58-5220)

Mildred White Turner, Ed.D.
Indiana University, 1958

Chairman: Dr. Louis G. Schmidt

The objective of this investigation was to determine the social status of mentally retarded pupils enrolled in special classes and to compare pupils with high social status and low social status on selected factors. An attempt was also made to discover behavior characteristics of the pupils in the two divergent groups.

The investigation was confined to the study of 390 Negro pupils enrolled in special classes for the mentally retarded in North Carolina during the school year 1956-57.

Data were collected by use of tests, cumulative records, teacher ratings, and personal interviews. A sociometric test was used to determine the social status of the pupils.

The high social status group consisted of 94 pupils who received 15 or more choices on the sociometric test. The 113 pupils who received three choices or less were in the low social status group. Comparisons of these two groups were made in relation to intelligence quotients, social quotients, chronological age, and teacher preferences. Three of these comparisons were made by applying the t-ratio test to null hypotheses for the difference between the means of the two groups. Chi square was used to test the null hypothesis regarding teacher preferences.

Findings:

1. The number of choices received on the sociometric test ranged from none to 27.
2. The difference between intelligence quotient means for the high social status group and the low social status group was significant at the 5 per cent level of confidence.
3. The difference between social quotient means for the two groups was significant at the 1 per cent level of confidence.
4. The difference between the chronological age means for the two groups was not significant.
5. There was no significant difference in teacher preferences for pupils of high social status or pupils of low social status.
6. Friendliness, compatibility in play, non-fighting, kindness, and propinquity were characteristics attributed to members of the high social status group by their peers.

Conclusions:

1. Social acceptance of these mentally retarded children was no different than social acceptance in a normal group; some pupils were highly accepted by peers and some were not.
2. Within special classes such as these there is wide variability in chronological age, mental age, social age, intelligence quotients, and social quotients.
3. In populations like the one studied pupils are likely to have higher social quotients than intelligence quotients.
4. Pupils with high social status had higher intelligence quotients and social quotients than pupils with low social status.
5. Chronological age was not a factor in determining social status of these pupils.
6. There was no relationship between social status of pupils and teacher preferences for having pupils in class.
7. Popular mentally retarded children were accepted by their peers for the same reasons as normal children.

Microfilm $2.00; Xerox $5.20. 102 pages.

EDUCATION, TEACHER TRAINING

A STUDY TO DETERMINE THE RELATIVE IMPORTANCE OF SELECTED PERSONAL FACTORS IN THE EFFECTIVE TEACHER

(L. C. Card No. Mic 58-2126)

Ruth Roberta Dugan, Ph.D.
New York University, 1958

Chairman: Professor Elwood Winters

The Problem

The purpose of this investigation was to determine the relative importance of selected factors (egocentricity and mental objectivity) in the effective teacher. Three specific problems were entailed: (1) To procure supervisors' rating of selected teachers on a scale appropriate for discrimination ranging from effective, through average, to

ineffective. (2) To design a questionnaire that would reveal selected personal factors in the teachers in the study. (3) To determine if selected personal factors correlated significantly with scores on the rating scale.

Selected personal factors were defined as two characteristics mentioned repeatedly in educational literature as affecting success in teaching: mental objectivity and egocentricity.

Procedure and Results

A structured questionnaire of teacher actions was designed and validated to measure egocentricity and mental objectivity in teachers.

Fifteen hundred questionnaires were distributed to teachers in the New York Metropolitan area. Two hundred seventy-two questionnaires were answered and returned to the investigator. Each teacher had been asked to name four supervisors capable of evaluating his teaching. All supervisors named by the teachers were sent a Critical Behavior of Teachers Rating Scale designed and validated by members of the Teacher Characteristics Study under the direction of Dr. David G. Ryans.[1]

One hundred eighty-five teachers were evaluated by their supervisors on the rating scale and the mean total (M_t) scores were derived. The distribution of M_t scores was positively skewed toward the effectiveness pole. The most effective teachers were defined as those having M_t scores below P_{15}, average teachers were those who had scores between P_{15} and P_{85}, and ineffective teachers were those who had M_t scores above P_{85}.

The M_t scores on the rating scales and the mental objectivity quotient scores (mental objectivity quotient score plus egocentricity quotient score always equals one, and thus eliminates the need of making separate tests for egocentricity) for the one hundred eighty-five teachers were compared and a Pearson's r of $-.030 \pm .005$ was derived. The mental objectivity scores of the most effective and the least effective teachers in the study were compared with their M_t scores on the rating scale. A Pearson's r of $-.104 \pm .018$ was obtained.

Conclusions

(1) The Critical Behavior of Teachers Rating Scale discriminated the effective teachers from the average, and the average from the ineffective teachers, although the mean total scores were skewed in the positive direction toward the effectiveness pole. (2) The Teacher Actions Questionnaire was a valid and reliable instrument to measure egocentricity and mental objectivity. (3) No significant correlation, either linear or non-linear, exists between effectiveness as measured by the Critical Behavior of Teachers Rating Scale and mental objectivity scores on the Teacher Actions Questionnaire.

General Statement

This study showed that for the teachers tested, egocentricity and mental objectivity have no relationship with effectiveness in teaching in general. There were many effective teachers who scored high in the trait of egocentricity; and vice versa, many teachers who were thought to be ineffective in carrying out accepted teacher behaviors by their supervisors and who score high in the trait of mental objectivity. The hypothesis that mental objectivity and egocentricity are important factors affecting effectiveness in teaching is rejected by this investigator. An effective teacher can be egocentric or mentally objective. Factors other than egocentricity or mental objectivity must be found to discriminate between causes of success or lack of success in teaching.

Microfilm $2.15; Xerox $7.60. 161 pages.

1. David G. Ryans, "The Investigation of Teacher Characteristics.", The Educational Record, October, 1953, p.382

A STUDY OF THE RELATIONSHIP BETWEEN PRIOR EXPERIENCES AND THE QUALITY OF CREATIVE WRITING BY SEVENTH GRADE PUPILS

(Publication No. 18,016)

Neal R. Edmund, Ed.D.
Syracuse University, 1956

Problem of the Study

The present study was designed to discover more information about the kinds of experiences seventh-grade pupils employ in their creative writing and how experience is related to the quality of their writing. It is concerned with the following specific questions:

1. Whether there is any relationship between a. the quality of creative writing, b. the total number of words employed, c. the number of descriptive words employed, and the kind of experience upon which the stories of seventh-grade pupils were based. 2. Whether there is any relationship between a. the sex of the writers, b. the desire to write stories, c. the number of stories written during the current school year, and the kind of experience used as a basis for their writing. 3. Whether seventh-grade pupils writing stories based on direct experience differ significantly in intelligence from those writing stories based on derived-experience.

Sources of Data

The sample consisted of ninety stories randomly selected from seventh-grade pupils in the Central New York area. Biographical and Story Background data were supplied by each pupil on a prepared form. Intelligence scores were obtained from the school records.

Method of Study

A story was identified as direct-experience-based or derived-experience-based on the basis of information supplied by pupils on the prepared forms. The forms were filled out by pupils after their stories were completed.

The stories were coded at random, story number 1, story number 2 and so on, and rated by a group of three judges, using an eleven point scale for rating the quality of creative writing. The rating scale was based on three main criteria: wealth and value of ideas, originality, and facility of expression. These criteria were not rated separately, but treated as one composite score. Each story received a final score, which was the median score for the three judges.

Stories of the direct-experience group and derived-experience group were compared on the basis of the total

number of words, number of descriptive words, and the quality of writing.

The direct-experience group and the derived-experience group of writers were compared on the basis of 1. desire to write stories, 2. number of stories written during the current school year, 3. sex and choice of experience, 4. intelligence.

Findings of the Study

1. The quality of the derived-experience-based stories of seventh-grade pupils was significantly superior to that of the direct-experience-based stories. The difference between the two groups was significant at the .001 level of confidence. 2. The derived-experience-based stories employed a significantly greater number of words than did the direct-experience-based stories. The difference was significant at less than the .05 level of confidence, with a probability value of .036. 3. The stories of seventh-grade pupils based on derived-experience employed a significantly greater number of descriptive words than did stories based on direct-experience. The probability value for this difference was (.033). 4. The derived-experience group differed significantly from the direct-experience group in the ratio of descriptive words to the total number of words employed. The difference was significant at the .001 level of confidence. 5. Girls wrote from direct-experience to a significantly greater degree than did boys. The difference between groups was significant at approximately the .05 level of confidence. 6. There was no significant difference in desire to write between the seventh-grade pupils basing stories upon derived and those basing their stories upon direct experience. 7. Neither group wrote a significantly greater number of stories during the current school year. 8. There was no significant difference between the two groups in intelligence.

Microfilm $2.00; Xerox $6.20. 126 pages. Mic 58-5226.

A COMPARISON OF THE FRESHMAN ELEMENTARY EDUCATION POPULATIONS AND SELECTED FACTORS ASSOCIATED WITH THEIR ENROLLMENT AT THE UNIVERSITY OF ILLINOIS AND EASTERN ILLINOIS STATE COLLEGE

(L. C. Card No. Mic 58-5472)

Hans Christian Olsen, Jr., Ed.D.
University of Illinois, 1958

This study was designed to compare freshman Elementary Education students attending the University of Illinois and Eastern Illinois State College in terms of their personal backgrounds. A comparison was also made of the relative importance these groups of students attributed to selected factors associated with their decisions to prepare for a teaching career, enroll in the Elementary Education program, and attend the institution of higher education of their choice. The present study was further designed to examine the relationship between the personal backgrounds of these two groups of students and the factors they indicated as important in making their choices in these three areas. The data were collected by means of a questionnaire.

Included in the population for this study were 279 freshman Elementary Education students attending the University of Illinois in May, 1957, and 79 freshman students enrolled in the corresponding curriculum at Eastern Illinois State College at the same time.

It was found that the Eastern Illinois State College students tended to come from lower socio-economic levels than did University of Illinois students. Fewer of them had fathers engaged in professional, semi-professional, or business occupations. They also tended to have parents with fewer years of schooling, have proportionately more mothers employed outside the home, come from larger families, depend less upon parents for financial support, do more part-time work while in college, and come from homes located in the area surrounding the institution they were attending. These students also held more scholarships and were less likely to be sorority members.

The two groups of students were in close agreement as to the relative importance they attributed to the factors related to their decisions to prepare for a teaching career, enroll in the Elementary Education curriculum, and attend the institution of their choice.

Both groups of students indicated that they were most influenced by the fact that teaching offered an opportunity to be associated with children and to be of service to society in choosing it for a career.

The two groups of freshman Elementary Education students were most influenced in their decision to enroll in the Elementary Education curriculums by past work with children, personal qualifications, the advantage of gaining a broad general education, the possible transfer of preparation to marriage and family life, and the variety of duties and activities which are a part of teaching.

The reputation of the institution and the recognition accorded its teacher education program, the opportunity of gaining a well-rounded general education background, and the possibility of meeting and being with people similar to themselves were most influential in these students' choice of institution of higher education.

Eastern Illinois State College students rated financial considerations and the proximity of that institution to their home as more important in their choice of institution of higher education than did University of Illinois students.

Microfilm $2.00; Xerox $6.80. 144 pages.

A SURVEY OF THE PROFESSIONAL QUALIFICATIONS, RESPONSIBILITIES, INADEQUACIES, AND NEEDS OF WOMEN PHYSICAL EDUCATION TEACHERS IN KANSAS SECONDARY SCHOOLS WITH IMPLICATIONS FOR TEACHER EDUCATION

(L. C. Card No. Mic 58-3880)

M. Evelyn Triplett, Ed.D.
The University of Oklahoma, 1958

Major Professor: Funston F. Gaither

This study was designed to present data concerning the professional status of women physical education teachers in Kansas secondary schools. The purpose of the study was to gather and summarize information concerning these teachers and the physical education programs they conduct

and to relate these findings to current teacher education practices. This involved an examination of the professional qualifications, the physical education facilities and programs of activities, the non-instructional responsibilities, the undergraduate training inadequacies, and the professional needs reported by these teachers.

Data were collected by means of a questionnaire sent to those persons listed as women physical education teachers in the 1956-1957 Administrators' Annual Report filed in the State Department of Education, Topeka, Kansas. The questionnaire was sent to 340 women physical education teachers, and 289, or 85.0 per cent, responded.

Women physical education teachers in third class schools in Kansas characteristically do not have so well rounded a background of professional training in physical education as do the teachers in first and second class schools. The program of physical education activities offered in third class schools tends to reflect this limited training.

The greatest feeling of inadequacy and concern for the value of the physical education program offered is expressed by the teacher who has only a minor in the field of physical education.

The supervised teaching experiences in physical education, according to the responding teachers, are not giving the teacher trainee the kind of professional preparation which should be found in this culminating educational contact. They feel that these experiences are largely unrealistic and impractical.

While they have only limited delegated guidance responsibilities, the women physical education teachers have close contact with student problems, have unusual opportunities for rapport with students, and actually have informal counseling contacts with students.

Characteristically, women physical education teachers have responsibilities either for health material or for health instruction or both.

Very few women physical education teachers provide corrective or remedial physical education classes for ill or disabled students. These few teachers feel inadequate in this work and have very limited help from either medical examinations or local physicians.

Evaluation in physical education is largely based on more or less intangible evidence, such as student attitude and interest.

Women physical education teachers are not using co-educational and co-recreational experiences to the extent that the inherent values would seem to warrant.

Comparatively few women physical education teachers hold membership in state and national physical education organizations.

Women physical education teachers express a desire for help through various types of inservice education. The professional needs expressed vary in type and specificity.

Microfilm $4.10; Xerox $13.80. 318 pages.

THE MEASUREMENT AND PREDICTION OF COOPERATING TEACHER EFFECTIVENESS IN MUSIC TEACHER EDUCATION

(L. C. Card No. Mic 58-5520)

Raymond Edmund Williams, Ed.D.
University of Illinois, 1958

This thesis is concerned with the multiple prediction of effectiveness in public school music teachers selected to supervise and counsel student teachers. It postulates that personality, musical discriminative skill, appropriate attitudes toward teacher-pupil relations, and appropriate interests are important factors to be considered in estimating the qualifications of a cooperating teacher in music. Instruments thought to be valid for the measurement of these factors provide data from which independent variables or predictors are selected. These instruments include:

1. The Music Preference Test of Personality, Raymond B. Cattell and Jean C. Anderson, Institute for Personality and Ability Testing, Champaign, Illinois, 1953.

2. The Aliferis Music Achievement Test, James Aliferis, Minnesota Press, Minneapolis, Minnesota, 1954.

3. The Minnesota Teacher Attitude Inventory, Walter W. Cook, et al, The Psychological Corporation, New York, 1951.

4. The Strong Vocational Interest Blank, Edward K. Strong, Jr., Stanford University Press, Stanford, California, 1954.

The measurement of effectiveness in cooperating teachers required the development of an instrument which would provide quantifiable data. This instrument took the form of a Student Teaching Inventory containing thirty-nine items descriptive of the helpfulness of the cooperating teacher with respect to specified responsibilities to the student teaching program. Responses are free from significant bias associated with sex or academic ability of the raters (student teachers). The Spearman-Brown split-half reliability test of 235 completed inventory forms yields r_{tt} = .97, corrected for attenuation. The correlation of pooled inventory scores and supervisors' ratings, r = .71, suggests that the data provided by the Student Teaching Inventory are valid indices of cooperating teacher effectiveness.

Data essential to the study proper includes: (1) scores for eleven personality factors, (2) separate scores for melodic, harmonic, and rhythmic discriminative ability, and total scores, (3) attitude scores, (4) interest scores, and (5) effectiveness scores. These data are descriptive of thirty-two cooperating teachers. The average number of inventory forms per teacher is 8.6. Scores from the Student Teaching Inventory are pooled for each teacher. The small number of subjects (thirty-two) is an effect of restriction imposed by pooling. The number of inventories for the cooperating teachers ranges from two to twenty-four.

Intercorrelations of independent and dependent variables were computed electronically. The matrices thus developed provide data which serve as the basis for selection of sets of multiple predictors.

Of the combinations tested, the most substantial relationship of mean Student Teaching Inventory scores was with three personality factor scores and music teacher interest scores. Their multiple correlation, corrected for bias associated with smallness of the sample, is .60, significant for rejection of the null hypothesis at the two per cent level.

A different set of variables is significantly related to a set of supervisors' ratings, R = .62, significant at the one per cent level. This set includes (in order of relative contribution to multiple correlation): (1) attitude scores, (2) two factors of the personality test, and (3) harmonic discrimination scores.

The analysis yields significant multiple relationships which suggest that student teachers' perceptions of cooperating teacher effectiveness are associated mainly with personality factors pertaining to cooperating teachers. Supervisors' judgments are associated with attitudes, personality factors, and harmonic discriminative ability, as measured by the test battery. Multiple regression equations based on relationships within the sample have an index of forecasting efficiency of approximately twenty per cent. Microfilm $2.15; Xerox $7.60. 163 pages.

EDUCATION, THEORY AND PRACTICE

TEACHERS' ATTITUDES TOWARD CHILDREN'S BEHAVIOR: A STUDY OF TEACHERS ATTITUDES TOWARDS CHILDREN'S BEHAVIOR PROBLEMS AND THEIR RELATIONSHIP TO PUPIL-TEACHER MORALE

(L. C. Card No. Mic 58-2125)

Ida S. Aaron, Ph.D.
New York University, 1958

Chairman: Professor Louis E. Raths

The purpose of this study was to compare the attitudes of today's teachers towards children's behavior problems with the teachers' attitudes found by Wickman in his study in 1928 and to examine the present attitudes to determine if any relationship exists between these attitudes and the quality of teacher-pupil rapport established in the classrooms.

It was hypothesized that the teachers' attitudes towards children's behavior is different today than it was over a quarter of a century ago and that this difference indicates a trend in which teachers are thinking in terms of the child's social and emotional growth as well as his intellectual growth. A second hypothesis was that a significant relationship exists between the teacher's awareness of the social and emotional needs of the child and the teacher-pupil rapport established in the class room.

It was assumed that a teacher-education program that stressed a consideration of the whole child would substantially influence the attitudes that teachers would develop towards children's behavior.

The study was limited to four elementary schools in Brooklyn, New York City, two of which were situated in an economically underpriveleged community and two of which were in a higher socio-economic community. The entire faculties of the four schools were involved in the study.

The original Wickman Scales were used to obtain a listing of all behavior problems encountered by the teachers and to obtain the ranking of seriousness of fifty selected problems. These rankings were compared first to the rankings of the Wickman teachers and second, to the rankings of a criteria score of clinicians used by Stouffer in his study of teachers' attitudes towards children's behavior. Twenty teachers were selected on the basis of a comparison of rankings of present teachers and the Stouffer clinicians. Ten of the selected teachers had received low ranking scores and ten had received high ranking scores. The teacher-pupil rapport of these twenty classrooms was obtained through the Wrightstone Pupil-Teacher Rapport Scale. A rank difference correlation was obtained between the Wrightstone Scores and the rankings of seriousness of the selected behavior problems.

The findings revealed no statistically significant difference between the rankings of seriousness of behavior problems of Aaron teachers and Wickman teachers. The findings indicated a significant difference in rankings of these problems between Aaron teachers and Stouffer clinicians. It appears that the behavior problems that are still of greatest concern to today's teachers are the problems relating to the immediate teaching situation, chiefly, annoying, disorderly, aggressive behavior. Teachers appear to be more concerned with characteristics of aggressive behavior than with helping pupils meet their basic emotional needs.

No statistically significant difference appeared in rankings of seriousness of these problems between the two contrasting socio-economic areas. There was, however, a significant difference found in the emotional climate in classrooms of teachers in the more favored socio-economic area as compared to climate in classrooms in the socio-economically deprived community. This was true despite the similarity of educational background, experience, and educational philosophy of the two groups of teachers.

The findings of this study have implications for the need for devising effective instruments to screen teacher personality in our teacher-selection methods; for the creation of out of school field work experience with children who have special needs as part of our teacher-training program; for experiences and study in mental hygiene with the goal of greater self insight for our teachers. The findings also have implications for our policy-forming group in the Board of Education to furnish additional help and support for teachers working in areas presenting special problems through such means as small classes and increased specialized and clinical services.

Microfilm $2.15; Xerox $7.60. 163 pages.

TEACHING FOR INTERNATIONAL UNDERSTANDING: BASIC STRUCTURE OF A SECONDARY SCHOOL COURSE UTILIZING THE FINDINGS OF SOCIAL PSYCHOLOGY AND CULTURAL ANTHROPOLOGY

(L. C. Card No. Mic 58-3900)

Glenn Chadwick Atkyns, Ph.D.
The University of Connecticut, 1958

Problem

The purpose of this study was to create the basic structure for a secondary school course devised to increase international understanding, utilizing pertinent research in social psychology and cultural anthropology. The course presents experiences and information calculated to move the students toward four goals set forth by the Society for the Psychological Study of Social Issues in its Third Yearbook and toward the characteristics of world-mindedness formulated by the International Relations Committee of the National Education Association, the Association for Supervision and Curriculum Development, and the National Council for the Social Studies.

Procedure

Studies from cultural anthropology and social psychology pertinent to teaching for international understanding were examined and the findings summarized. A course framework was formulated utilizing these findings. Techniques of instruction and subject content were recommended based on the findings from cultural anthropology and social psychology. Conclusions were drawn and recommendations made.

Results

The basic course structure was formulated on the basis of findings in social psychology and cultural anthropology. The course organization has psychological, sociological and logical aspects:

Psychological.--A group-centered, group-planning approach working on cooperative and individual projects is emphasized. A concept of being a homogeneous group and task-centered cohesiveness is encouraged. The social power of individuals in the group is utilized. Presentation emphasizes personal factors in perception, the role of salience, the use of credible communicators, with a "both sides of the argument" approach. Specific techniques include catharsis, case studies, role playing, and forced contacts. Particular attention is given to the cultivation of the ability of self-insight on the part of the student and an understanding of the role of frustration in aggression and scapegoating. Mass media of communication are employed together with appeals to values such as patriotism and religion. Activities involving international participation are included.

Sociological.--The subject matter is selected to give students an awareness of the economic-social-political order in which they live. The main body of the subject matter, drawn primarily from cultural anthropology, consists of area and national character studies which encompass key areas of the world. The area studies include information from economics and geography. The national character studies include examination of the culture patterns, universal culture patterns, real and ideal personality, congruence, and social continuity. Literature and other contributions of each culture are examined. Area and national character information is combined with information from history and political science in the study of world problems. The world problems studied are both those of "current" news and those of a continuing nature. The course seeks to build mental pictures that develop expectations and habits which support peace.

Logical.--The course is a core class (English-social studies). It is instituted at the twelfth-grade level because this grade is most conducive to school-initiated change of student attitudes. Social supports of discrimination are undermined while student democracy is encouraged. Administrative support includes exchange personnel, teacher selection, and funds.

Conclusions

Social psychology and cultural anthropology make significant contributions to teaching for international understanding. Selected findings from these fields have been incorporated in the proposed course. The psychological and sociological aspects of the course are justified by cited research or accepted educational practice. The logical aspects of the course are practical in terms of existing school conditions. The course provides a multidimensional approach to the goals set forth. By-products of the course should include better intergroup community relations and a more responsible citizenry.

Microfilm $2.60; Xerox $9.00. 197 pages.

THE DEVELOPMENT OF A TEST OF CRITICAL THINKING FOR PUPILS IN GRADES FIVE AND SIX

(L. C. Card No. Mic 58-3903)

James Murray Burke, Ph.D.
The University of Connecticut, 1958

Statement of the Problem

The purpose of this study is to develop a test of the ability to do critical thinking. The test is particularly designed for use in grades five and six, but may also be used in grades four and seven. There are five parts to the test: Recognizing Reality, Making Inferences, Weighing Evidence, Reasoning, and Recognizing Humor.

For operational purposes in the study, critical thinking was considered to involve the ability to recognize reality, to observe and analyze data, to form and apply generalizations, to seek and apply evidence, and to use language with discrimination.

Procedure

Professional literature relating to the problem was reviewed. Planning the test involved the identification of behavioral objectives to be measured, and the organization of those objectives into groupings to facilitate item writing.

A first draft of the test was constructed on the basis of the selected objectives. Involved in this phase of the study were the following steps: choosing item types, weighting parts, selecting materials for the test content, and writing the test and the directions to the examiner.

The first draft was criticized and revised, and the test was administered to 374 fourth, fifth, and sixth grade pupils in seven selected Connecticut schools. The results of this test administration were analyzed in terms of reliability and of item validity.

The test was again revised in the light of this analysis. The test was again subjected to critical review, and was revised a third time.

The final stages of the test development involved the standardization process. The finally revised test was administered to 945 fifth and sixth grade pupils in fifteen school districts in ten states throughout the nation. Test reliability and validity were investigated, and norms were established.

Results

Test reliability was estimated by correlating scores on split halves of the test and stepping up the obtained coefficients by use of the Spearman-Brown prophecy formula. These stepped-up reliability coefficients were found to be .864, for the grade five standardization group, and .845, for the grade six standardization group.

A correlation coefficient of .521 was found between scores on the Watson-Glaser Critical Thinking Appraisal and the test developed in the present study. The tests in this case were administered to a group of 153 seventh grade pupils. This finding was submitted as evidence of validity.

Further findings related to validity were presented. A significant difference was found to exist between the means of the grade five and the grade six groups. In this case the ratio of the difference between the means to the standard error of that difference was found to be 4.33.

Part-score intercorrelation coefficients ranged from .238 to .565 in the fifth grade group, and from .317 to .520 in the sixth grade group. Correlation coefficients of part scores with the total score ranged from .636 to .781 in the fifth grade group, and from .648 to .801 in the sixth grade group.

Correlation coefficients of the test scores with mental ages and with intelligence quotients proved to be positive, but they ranged widely among groups and among intelligence tests.

Norms were presented in the form of selected percentiles for each of the two grades.

Conclusions

The test was considered to have an acceptable degree of reliability. Evidence of validity suggested that the test does measure critical thinking ability.

Two uses of the test were offered. One is as a measurement of the degree to which pupils in general are able to think critically. The second is as a source of identification of gifted children.

Microfilm $2.60; Xerox $9.00. 200 pages.

POLICIES AND PRACTICES OF DEPARTMENT STORES AS RELATED TO EXECUTIVE TRAINEES

(L. C. Card No. Mic 58-5202)

Robert M. Cameron, Ed.D.
Indiana University, 1958

Chairman: Dr. H. Robert Kinker

Statement of the Problem

The primary purpose of this investigation was to bring together and examine the policies and practices of department stores as these relate to their training programs for potential executives.

Methods of Procedure

A preliminary inquiry form was validated in a number of department stores by means of personal interviews. In each case the executive in direct charge of the executive trainee program was the person interviewed. After revision of the inquiry form was made, copies were sent to 276 department stores throughout the country. Only department stores with an annual sales volume of $5,000,000 and over were included in this study.

Findings and Conclusions

1. It was found that 23 per cent of the responding stores did not regularly recruit college graduates. Department stores, as a group, might attract more graduates into their training programs if they exerted more effort in recruiting them.

2. Store executives, who recruited on college campuses, evaluated the attitudes of various college personnel towards careers in department store work for college graduates. Deans of schools of business administration, professors of economics, and college placement bureau officials in particular, held attitudes that were unfavorable, according to the store executives. Unfavorable attitudes were believed by store executives to be held by 31 per cent of the deans of schools of business administration, 36 per cent of professors of economics, and 43 per cent of placement bureau officials. If the attitude evaluations made by the store executives reflect the actual attitudes held by these college professors and administrators, it would appear that store executives have much work to do in establishing a better understanding and greater appreciation of retailing careers among college personnel.

3. The findings of this study showed that 87 per cent of the participating stores regularly recruited their in-service personnel for the executive development programs. The in-service personnel, in most cases, were people without college training. This points up the fact that young people, without college education, should not overlook the career possibilities in department stores. It should be noted, however, that in 83 per cent of the stores high school graduation was a requirement for appointment to executive training.

4. Representatives of 48 per cent of the stores studied felt that their trainee salaries were not competitive with salaries offered college graduates in other fields of work. It seems obvious that department stores, as a group, cannot recruit a sufficient number of college graduates as long

as almost half of their group offer non-competitive salaries. Salaries offered trainees must become competitive to achieve desired results.

5. It was apparent that there was little uniformity in the so-called job rotation plans of the participating stores. It would seem that the term "job rotation" was misused when trainee assignments on any particular job extended over 12, 16, 20, 24, and 52 week periods. It is conceivable that such extended assignments might be to the advantage of the trainee; but it is likewise possible that a trainee might feel "forgotten" under such a plan. To the credit of the majority of the stores studied, specific work assignments for any single job did not extend beyond eight weeks.

6. Approximately 62 per cent of the executives representing the stores included in the study felt that their training efforts over the past five years had not produced a sufficient quantity of qualified young management personnel. It is clear, therefore, that the department stores management group must exert greater efforts to remedy this shortcoming. The matters of selection, salary, teaching methods and job satisfaction must all be evaluated carefully. Microfilm $2.50; Xerox $8.60. 190 pages.

THE RELATIONSHIP BETWEEN PERSONALITY AND ACADEMIC ACHIEVEMENT (READING AND ARITHMETIC) OF SEVEN YEAR-OLDS

(L. C. Card No. Mic 58-5204)

Cleo Dorris Carter, Ed.D.
Indiana University, 1958

Chairman: Ruth G. Strickland

This study was an investigation of the relationship between personality and certain elements of academic achievement (arithmetic and reading) of a group of seven year-olds. Intelligence and socio-economic status were recognized as secondary variables relevant to both of the primary variables (personality and academic achievement) being investigated. The central problem of the study was defined to consist of the following:

1. To measure the relationship between personality and academic achievement independently of the secondary variables.
2. To determine to what extent academic achievement is predictable from personality, intelligence, and socio-economic status.

For the purpose of this study, personality was defined as a combination of personal adjustment and social adjustment. Academic achievement was determined by measuring arithmetic achievement (fundamentals and reasoning) and reading achievement (vocabulary and comprehension).

The sample for this study consisted of 196 seven year-olds located in eight classrooms of six public schools in southern Illinois. The California Test of Personality (Form AA, 1953 Revision, Grades Kindergarten-3), the California Short-Form Test of Mental Maturity (Grades 1-3), and the California Achievement Test (Grades 1-2-3-L4) were administered to all of the subjects. All of the subjects were rated for socio-economic status on the basis of the Warner Status of Characteristics Index.

The sample was first divided into approximately equal groups of differing socio-economic levels. These groups were compared in personal adjustment and social adjustment, and found to differ significantly in the former. These groups of high, middle, and low socio-economic levels were kept distinct through all ensuing portions of the analysis.

Each of these different socio-economic groups was next divided into three approximately equal subgroups on the basis of personal adjustment scores. These subgroups of high, middle, and low personal adjustment within each socio-economic group were then compared on the basis of arithmetic achievement and reading achievement scores. These comparisons were carried out by covariance analysis, with intelligence used as the measure of initial ability (or pretest). No systematic significant differences were found to exist, and it must, therefore, be concluded that, within the sense of this analytic method, personal adjustment and academic achievement are not significantly related.

Similar analysis carried out for social adjustment and total personality, respectively, likewise failed to yield any systematic differences (although significant differences in raw academic achievement scores could frequently be observed).

It must, therefore, be concluded that there is no significant relationship between personality (personal and social adjustment) and academic achievement (arithmetic and reading), when the latter measure is adjusted for difference in intelligence.

Coefficients of multiple correlation were computed for the different socio-economic groups between academic achievement on one hand, and intelligence and personality on the other. All of the coefficients obtained were significant at least at the 0.05 level of confidence, with standard errors of estimate ranging in magnitude somewhat below the corresponding standard deviations for the predicted variables. However, the correlation of academic achievement with intelligence and personality jointly does not appear to be significantly better than the correlation of academic achievement and intelligence alone.

Further study and research is needed regarding the abilities, needs, and interests of the period of early childhood, so that teachers may have more scientific knowledge to use in prescribing a program of school living for their children. Study and research are needed on the non-academic type of abilities and achievements of early childhood, as well as further study of the personal and social factors revealed in the social relationships of young children.

Educational leaders are not satisfied with their knowledge of the relationship of the child's emerging personality to his learning and achievement nor are they sure of how much effect his school experience and his achievement have on his personality. Further study is needed of both aspects of the problem.

Microfilm $2.00; Xerox $4.80. 94 pages.

A STUDY OF SELECTED AREAS OF THE SYSTEM OF SOCIAL FRATERNITIES AT MICHIGAN STATE UNIVERSITY

(Publication No. 20,820)

Robb Golder Gardiner, Ed.D.
Syracuse University, 1956

To what extent does the college fraternity, as it operates on campuses today, substantiate the claims of its backers or the charges of its critics? This study proposes a partial consideration of this question through the examination of selected areas of the system of social fraternities on one university campus--that of Michigan State University.

Six areas of the Michigan State fraternity operation are examined:

1. fraternity membership,
2. fraternity member selectivity,
3. fraternity indoctrination,
4. fraternity scholarship,
5. fraternity activities,
6. fraternity administration.

The study is primarily a qualitative analysis rather than a quantitative one. The writer relies heavily on the inductive classification technique, with limited use of simple statistical procedures where these have seemed to make a contribution.

The study utilizes several approaches and a variety of source materials including questionnaires, interviews and records and reports. Although considerable objective material is used, this is supplemented by subjective opinion and personal reactions to help clarify the program and point up areas of strengths and weaknesses.

The conclusion presents:

1. a list of strengths and weaknesses in the Michigan State fraternity operation,
2. recommended proposals for the improvement of the operation,
3. considerations relative to the role of the fraternity in today's educational pattern,
4. suggested proposals for further investigation in the fraternity area.

From this study of one fraternity system, the writer indicates a continued role--even a more significant one--for the college fraternity, providing three conditions are met:

1. Fraternity Nationals are willing to face the issue of membership selectivity realistically, making a sincere effort to fall in line with the enlightened spirit of the times on this issue.
2. Fraternity and college administrations are willing, in actuality, to assume joint responsibility for the sponsorship of fraternity chapters--groups that by their very nature demand that coordinated sponsorship.
3. Fraternity membership is willing to undertake a policy of serious evaluation and improvement of their program and operation, with their own stated objectives as standards.

Microfilm $4.80; Xerox $16.00. 374 pages. Mic 58-5227.

AN ANALYSIS OF VARIOUS FACTORS RELATED TO MARKING PRACTICES IN UNDERGRADUATE COURSES

(L. C. Card No. Mic 58-3919)

Philip Richard Harvey, Ph.D.
The University of Connecticut, 1958

PURPOSE

The purpose of this study was to report the characteristics of distributions of certain undergraduate course marks assigned within a large state-supported university and to analyze these variously in terms of factors that were hypothesized as being influential in determining the nature of mark distributions.

PROCEDURE

Basic data for the study were all undergraduate marks at two course levels assigned on the Storrs campus of the University of Connecticut during 1953-54. Supplementary data were undergraduate marks assigned at the Storrs campus at the same course levels during the four-year period from 1950-51 to 1953-54. Additional supplementary data were marks assigned at the two course levels in the Hartford, Stamford, and Waterbury centers of the University during 1953-54.

Three similar basic analyses were presented for the Storrs campus distributions for 1953-54, the Storrs campus distributions for the period 1950-51 to 1953-54, and the University center distributions for 1953-54. Three somewhat more specific analyses were presented by school or college, by department, and by instructor. Three highly specific analyses were made by sectioned courses, by instructional outcomes of courses, and for classes grouped according to size.

Nearly all analyses entailed the use of course level and semester in which marks were assigned. Shown in each analysis were number of marks, percentage distribution of marks, and the means and standard deviations of quality point ratios. Detailed analyses were made of variations in mean quality point ratios, and the conformance of distributions of marks for schools and colleges, departments, and instructors to reference distributions of all Storrs campus marks. Also employed in the study were categories of courses based on types of students to which they are open and the prerequisites for registration.

MAJOR FINDINGS AND CONCLUSIONS

Substantially all distributions of marks included in this study had larger proportions of high marks than low marks. This trend was more noticeable as the educational levels of the students increased and was more pronounced during the second semester than for the first semester. The pattern of marking for the University campus as a whole was relatively consistent for the four-year period from 1950-51 to 1953-54. The marks in lower-level courses for three off-campus centers had higher mean quality point ratios and the variability of marks was greater. At the upper level no consistent relationship between centers was found. The lack of comparability of marks for schools, and colleges, departments, and individual instructors was shown by extreme differences in marking patterns and the significant

variations from appropriate University campus reference distributions which were reported for each of the three groups. Significant differences were found in the mean QPRs of groups of instructors based on rank and tenure; however, no consistent relationships appeared to exist between these factors and the marks assigned. The mean QPRs of younger instructors tended to decrease with age while among older instructors no consistent relationship was found among the mean QPRs. The comparison of mean QPRs in courses with several sections indicated that significant differences existed among instructors in many courses to the extent that the marks as a group appeared to be more closely related to the chance assignment to the various sections than to the achievement of students. For courses with different instructional outcomes, the courses classified as aesthetic had significantly higher mean QPRs than those for the social science, tool, and natural science areas, while those for the natural science area tended to be lower than the other three areas. Marks in small classes were found to have higher mean QPRs than those for larger classes and in the latter groups higher percentages of marks were assigned in the middle of the marking scale. Microfilm $3.05; Xerox $10.40. 234 pages.

A SURVEY OF THE USES MADE OF COMMERCIAL TELEVISION PROGRAMS BY TEACHERS IN THE ELEMENTARY SCHOOLS OF INDIANA

(L. C. Card No. Mic 58-5207)

Rowland Dean Klink, Ed.D.
Indiana University, 1958

Chairman: Hanne J. Hicks

Problem

The purpose of the study was to determine the uses elementary teachers make of commercial TV programs.

The three major aspects of the study were to determine the extent to which elementary teachers use commercial television programs in their teaching, the specific ways in which they make use of commercial TV programs in their teaching, and the results that they feel are achieved from their use of commercial TV programs in their teaching.

Procedures

The data were obtained by a specially constructed questionnaire mailed to a randomly selected group of Indiana teachers. Information on the returned questionnaires was categorized and transferred to Hollerith cards. Statistical treatment of the responses was limited to frequency tabulation and computation of percentages.

Major findings

The following were the major findings of the investigation:

1. Data based on items in the questionnaire concerning sex, age, and marital status paralleled to a great extent that reported in the 1950 census statistics for teachers in Indiana.
2. Approximately three fourths of the respondents had had four or more years of college preparation.
3. More than one half of the teachers had had 15 or more years of teaching experience and nearly 13 per cent had taught more than 30 years.
4. The majority of the teachers owned TV sets and viewed regularly.
5. The majority of the teachers felt that viewing commercial TV programs offered entertainment or education features which were only of moderate excellence.
6. More than one half of the teachers felt that certain learning resulted from watching commercial TV programs.
7. Few of the teachers made regular planned use of commercial TV programs.
8. Nearly one fifth of the teachers judged that their use of television in the classroom had resulted in a total of 37 behavioral changes among the pupils. Results most frequently mentioned were deepened impressions of history and a greater interest in and understanding of science.
9. Approximately 100 different TV programs were mentioned as having value for teaching.
10. The most frequent requests of teachers concerning changes which would facilitate their use of commercial TV programs were that advance information, suggestions for profitable use, and special professional education for TV utilization be provided.
11. From the standpoint of sound educational objectives, nearly one half of the respondents felt the time children spent watching commercial television was moderately profitable.
12. The predominant content of commercial TV shows was believed to be humorous and exciting but acceptable by the majority of the respondents.

Conclusions

Major conclusions based on the findings of this study were:

1. The teachers in this study appear to be representative of all teachers in Indiana.
2. In general, teachers feel television causes children to read less, though it has created new interests and improved their speaking vocabulary.
3. Discussion is the classroom activity usually engendered through the use of television.
4. Commercial TV programs, in general, contain values which are useful in education.
5. The educational values found in commercial TV programs are predominantly useful in areas of social studies, science, and character development.
6. Classroom utilization of commercial TV programs most frequently result in improved concepts and deeper interest.
7. Teachers generally do not feel a need for teaching children to select and view programs with discrimination and discernment.
8. Teachers feel that there is little pertinent material contained in commercial TV programs.

Microfilm $2.50; Xerox $8.60. 190 pages.

THE EFFECTS OF EDUCATIONAL FILMS ON STUDENT PERCEPTIONS

(L. C. Card No. Mic 58-3497)

Robert Edward Krebs, Ed.D.
The University of Florida, 1958

This study attempts to find out whether a series of related educational films, used as the basis for common experiences, has any effect on the likeness of the viewers' perceptions.

Two comparable classes in high school chemistry studied two topics which were taught with the aid of a series of topic-related films. For the first, "Atomic Energy," the experimental groups saw the films while the control group did not. For the second, "Organic Chemistry and Petroleum," the groups were switched, i.e., the former experimental group became the control group and did not see the films, while the former control group became the experimental group and did see the films.

A series of tests was given to each group before the study of each topic, at the end of the study of each topic, and four weeks after the study of each topic.

For the first test students gave interpretations to projected silhouettes. The second test was a factual-knowledge test of the multiple choice type. The third test was a multiple choice type where all the answers were considered correct. A fourth test, a psychological examination, was given to each student to compare the groups as to their mental abilities.

The t test was used to determine any statistically significant difference between the mean scores of the two groups.

The F ratio was used to determine if there was any statistically significant difference between the variances of the test scores.

The z test was used to compare per cents of responses for some tests for statistical significance.

Although the data and results of the tests were not completely consistent, there was enough evidence to support certain conclusions concerning the following hypotheses:

1. The members of the experimental (film) groups will perceive the specific learning situation more alike than will the control (non-film) groups.

Although the test results were not consistent, there was an indication that the experimental groups did perceive specific learning situations more alike.

2. Providing a more common experience, the viewing of related films, will help students to perceive or "see" facts, information, abstractions, relationships, ideas, and answers more in the same way.

Again, although the test results were not consistent, there seemed to be a trend for the experimental groups to perceive more alike.

3. The experimental groups will show less variance or "spread" in their test scores than will the control groups.

There was no conclusive evidence that related films will reduce the "spread" of scores for a viewing group with the possible exception of the scores from a factual-knowledge test.

4. The experimental groups will have higher scores (means) for the tests given than will the control groups.

The experimental groups did not have a consistently higher mean score for both topics except for the topic-related responses for the irrelevant silhouettes.

5. The experimental groups will have retained more of the knowledge gained after a period of four weeks than will the control groups.

There was no evidence that the experimental groups retained more factual knowledge after four weeks than did the control groups.

Changing perceptions and effecting a similarity of perceptions for a large diverse group of individuals would be extremely difficult if not impossible. This difficulty arises because of the many varied experiences which any large group of individuals have during their lifetime. When a more homogeneous group such as was used for this study is considered, the possibility of changing and causing a similarity of perceptions seems not only feasible but possible. Microfilm $2.00; Xerox $6.60. 136 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, AERONAUTICAL

THEORETICAL ANALYSIS OF ELASTIC AND PLASTIC BUCKLING OF POLYGON-SHAPED PLATES UNDER VARIOUS EDGE LOADINGS AND SIMPLY SUPPORTED BOUNDARY CONDITIONS

(L. C. Card No. Mic 58-3528)

Ibrahim Kutsi Ebcioglu, Ph.D.
University of Minnesota, 1958

Adviser: Chieh-Chien Chang

The present thesis is concerned with the theoretical development of the elastic and plastic buckling of plates. The equations derived by Ilyushin[1,2] for incompressible materials are extended to compressible materials. The results are applied to the instability of hexagonal shaped plates and the critical buckling stresses are determined for plates with simply supported edges under a hydrostatic lateral compression load, or a uniaxial lateral compression load.

The collocation and finite difference methods are used in the application of the theory. The first method is applied to skew hexagonal plates with simply supported edges and under hydrostatic lateral compression. The latter method is applied to regular hexagonal plates with the same boundary conditions but the compressive load is taken parallel to the x-axis or y-axis.

The critical buckling loads of hexagonal plates are compared with the critical buckling loads of equivalent square plates with the same boundary conditions and loadings. The results show that the critical buckling load of an equivalent square is 7% higher than the critical loads of hexagonal plates.

The above methods can be used for any arbitrary loadings, skew, regular hexagon, or polygon-shaped plates, and for any boundary conditions. The monotonically increasing character of the critical load with the mesh number makes numerical calculations very practical, especially when computing machines are used. For many practical purposes mesh number = n = 3 or 4 may give satisfactory results. Microfilm $2.00; Xerox $5.40. 110 pages.

1. Ilyushin, A. A. "Stability of Plates and Shells Beyond the Proportional Limit", NACA, TM 1116, Oct. 1947.

2. Ilyushin, A. A. "The Elasto-Plastic Stability of Plates", NACA TM 1188, Dec. 1947.

CHARACTERISTICS OF FLOW AROUND BLUNTED CONES WITH AXIAL SYMMETRY AT SUPERSONIC SPEEDS

(L. C. Card No. Mic 58-5087)

William Holland Shutts, Ph.D.
The University of Texas, 1958

Supervisor: Dr. M. J. Thompson

A theoretical and experimental investigation was conducted to determine the characteristics of supersonic flow over blunted cones. Two families of blunted cone models were tested at a nominal Mach Number of 4.9. One family consisted of sixteen spherically blunted cones with various nose radii and cone angles; the other family consisted of five blunted cones with nose shapes ranging from a flat nose (truncated cone) to a spherical nose, the intermediate models having flat faces with increasingly larger shoulder radii. Also one model with a concave nose and one model with a cylindrical nose were tested. Pressure distribution measurements were made on the nose and conical afterbody together with schlieren observations of the form and location of the detached shock wave. All tests were at zero angle of attack. The test Reynolds Number per inch ranged from 7.8×10^5 to 1.05×10^6.

A theoretical analysis was made of the hypersonic inviscid flow past an unyawed body of revolution with a spherical nose shape. Constant density was assumed in the nose region near the axis of symmetry between the detached shock wave and the body. The results were compared with experimental data and with other theoretical analyses bearing on this problem. It was found that the analysis predicted results that were qualitatively correct but the quantitative results were only in fair agreement with test data. Because of the assumption of constant density, the solution was valid only in the region near the axis of symmetry.

Experimental results were presented in the form of pressure distribution plots and schlieren photographs for each of the models tested. It was found that the ratio of the shock-wave detachment distance to the nose radius for the spherically blunted cone models was unaffected by variation of the apex semi-cone angle from 10^0 to 25^0, but that this ratio decreased slightly with increasing nose radius for a given cone angle within the range of values tested.

The surface pressure distribution on the nose of the spherically blunted cone models, predicted by the modified hypersonic Newtonian theory, agreed quite well with the experimentally measured values. The pressure distribution in the vicinity of the sphere-cone junction and along the conical surface was characterized by a region of overexpanded flow immediately aft of the junction followed by a gradual recompression toward pressures given by cone theory along the conical surface. The overexpansion was greatest for the models with the higher cone angles and decreased to approximately zero for apex semi-cone angles of 10^0.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A slower initial expansion on the flat-faced models was followed by a more severe overexpansion in the region just aft of the shoulder. Pressure recovery along the conical surface was relatively more rapid for these models than for the spherically blunted models. The pressure on the conical surface predicted by cone theory agreed quite well with experimental results aft of the recompression region.

Microfilm $2.00; Xerox $6.80. 145 pages.

ENGINEERING, CHEMICAL

THEORETICAL AND EXPERIMENTAL STUDIES IN BATCH RECTIFICATION

(L. C. Card No. Mic 58-3487)

Donald Ernest Danly, Ph.D.
The University of Florida, 1958

This dissertation reports the results of work undertaken to devise practicable but rigorous computation methods for binary batch rectification. A rigorous mathematical description, consisting of differential-difference equations, is presented for unsteady-state conditions in plate-type distillation columns. Two approaches are taken to the solution of these equations, as applied to batch rectification of a binary mixture at constant reflux ratio. The assumptions made are: (1) negligible amount of vapor holdup in the column compared with liquid holdup, (2) negligible heat losses from the column, (3) constant holdup in the system, and (4) no backmixing of flow in the condenser-accumulator system.

The first approach to the solution of the differential-difference equations involves integration by numerical methods, employing an I.B.M. 650 computer. A complete description and listing of the computer program is given. Included in the program is a preliminary steady-state calculation for the case normally encountered in practice, where the initial overhead composition is unknown and must be determined by an iterative process. Following the steady-state calculation, this same program provides a numerical integration of the unsteady-state equations. The average product composition and instantaneous compositions of the overhead vapor and the liquid on each plate and in the kettle are punched at designated intervals of the fraction distilled. Periodic material balances are made of the more volatile component in order to provide a measure of the accumulative error of the numerical procedure.

Equations are derived for estimating the increment size necessary to give convergence and stability of the numerical formulas employed in the computer solution. The validity of the results of the calculation procedure is substantiated by the close agreement of experimental and calculated batch rectification curves.

Using the computer program to develop batch rectification curves, the error resulting from the indescriminate use of molar units in representing the data is demonstrated for a system for which there is a large variation in the moles of holdup with composition. Normally, the use of weight units is satisfactory with respect to constancy of holdup, but in cases where the densities of the two pure components are greatly different, pseudomolecular weights can be defined such that the pseudomolar volumes of the two components in the saturated liquid state are equal.

The use of the computer program is also illustrated in the development of data required for the determination of the optimum operating conditions for a given separation.

The second approach to the solution of the unsteady-state distillation equations is based on the method of Huckaba and Tour, and should be primarily of interest to designers who do not have access to an electronic computer. This method involves the assumption of the entire curve of product composition versus fraction distilled, followed by successive calculation of the corresponding curves for each plate until the still liquid composition is reached. The assumed curve is then checked by an overall material balance performed by graphical integration, and the entire calculation is repeated, if necessary. Although the procedure is rather time-consuming, it appears to be faster than performing a numerical integration on a desk calculator or slide-rule, because of the extremely small increments in the fraction distilled that must be employed in the latter method in order to achieve stability.

Encompassed within the two methods, therefore, are the requisites for making batch rectification calculations with confidence.

Microfilm $2.55; Xerox $9.00. 196 pages.

TURBULENT FLOW OF NON-NEWTONIAN FLUIDS IN SMOOTH ROUND TUBES

(L. C. Card No. Mic 58-5284)

Donald W. Dodge, Ph.D.
University of Delaware, 1958

Supervisor: A. B. Metzner

Prior work on the subject of turbulent flow of non-Newtonian fluids through smooth round pipes has been entirely empirical and limited in scope to fluids which tended to approach Newtonian behavior at the shear stresses prevailing under turbulent conditions. The present work represents the first theoretical attack on the problem of turbulent non-Newtonian flow, and has yielded a completely new concept of the attending relationship between pressure loss and flowrate. In addition, the analysis has permitted the prediction of turbulent non-Newtonian velocity profiles, a topic about which the literature is entirely void.

In order to confirm the theoretical analysis, experimental data were taken both with polymeric gels and solid-liquid suspensions in turbulent flow inside 1/2, 1, and 2 inch round tubes. A total of nine non-Newtonian materials, with flow behavior indices between 0.3 and 1.0 were studied after the system had been checked with two Newtonian fluids. Reynolds numbers ranged as high as 40,000 with the non-Newtonian systems. All of the fully turbulent experimental data supported the validity of the theoretical analysis.

The final correlation obtained represents a generalization of von Karman's equation for Newtonian fluids in turbulent flow, and is applicable to all non-elastic, time-independent fluid systems irrespective of their rheological classification. The latter restriction of time-independency, however, is of little practical importance. All turbulent

experimental data (some 146 points) were correlated by this final relationship with a mean deviation of 1.9 percent.

The theoretical analysis presented by this work should provide a rational basis for future investigations into related problems of turbulent non-Newtonian mechanics.

Microfilm $4.10; Xerox $13.80. 320 pages.

CHARACTERISTICS OF SPIRAL FLOW

(L. C. Card No. Mic 58-5410)

Robert Newcomer Eby, Ph.D.
University of Illinois, 1958

A study was made of the spiral flow fields in flow systems of two shapes. The first was in a straight pipe 8 inches in diameter and 59½ inches long with a tangential entrance and exit at opposite ends. The other system was similar to a cyclone separator, with the same pipe and entrance and with a 4-inch diameter exit tube at the end next to the entry. Inlet velocities of 50, 100, and 180 feet per second were used in the straight pipe, and 100 feet per second in the cyclone. In both systems the mean velocity vector was located and measurements of the mean axial, tangential, and radial components of velocity were made with an impact cylinder and a sensitive constant-current hot-wire anemometer with crossed-wire probes of 0.139-mil tungsten wires. Measurements of the longitudinal and transverse intensities of turbulence and the mean value of the product of these two turbulent velocities were made with the hot-wire anemometer.

The shape of the velocity fields was a function of the geometry of the system and independent of variations in the absolute value of the gas velocity.

An outward radial component of velocity found in the straight pipe was negligible in the cyclone.

The flow field in the straight pipe with a rectangular tangential entry was highly asymmetric with two interlocking spirals. The larger spiral moved down the outside of the cylinder in the form of a helix and contained 80 to 90 per cent of the total gas flow. The smaller spiral moved in the reverse direction near the center of the pipe and interlocked with the larger spiral. There was a region in the larger spiral where the mean tangential velocity, U_t, varied inversely with the distance from the axis of the pipe, r. The longitudinal intensity was in the same direction as the mean velocity vector, while the transverse intensity was normal to the longitudinal intensity and in the plane defined by the mean velocity vector and its radial component.

In the cyclone, the velocity flow field was symmetrical about the axis. The axial velocity profiles across any diameter had the shape of the letter "W". The variation of U_t with r depended on the geometry of the cyclone. The values of n in the equation, $U_t = \frac{K}{r^n}$, were characteristic of the cyclone design. The value of 0.5, which has been reported previously, is not inherent in the nature of the double spiral field of a cyclone.

In both systems, the values of the longitudinal and transverse intensities decreased with increase in the mean velocity. The longitudinal and transverse intensities had minimum values near the wall and increased in value toward the axis. Microfilm $2.00; Xerox $6.40. 134 pages.

MASS TRANSFER EFFICIENCIES IN BUBBLE-CAP DISTILLATION SYSTEMS

(L. C. Card No. Mic 58-5288)

Arthur B. Hill, Ph.D.
University of Delaware, 1958

The effects of operating and design variables upon bubble-cap plate efficiencies were studied in a 2-ft. diameter pressure distillation column for the systems acetone-benzene at 7.4 to 80 psia. and n-pentane - p-xylene at atmospheric pressure. Liquid rates were varied within the range of 10 to 55 gal./min. and gas rates from 30 to 95 percent of flooding.

The acetone-benzene system contained 85 to 95 percent of its resistance to mass transfer on the gas side of the interface while neither resistance was dominant in the pentane-xylene study. In both systems, it was necessary to correct the experimental plate efficiencies for incomplete liquid mixing in the crossflow direction.

The acetone-benzene study confirmed previous literature assertions that the gas phase resistance to mass transfer, as well as the hydraulic characteristics are functions of the F-factor. A small increase in gas phase resistance was noted with increasing gas rate, decreasing liquid rate, or decreasing weir height. Good agreement was obtained with the gas phase results for ammonia absorption.

The pentane-xylene study indicated that the liquid phase mass transfer coefficient is mainly a function of the gas rate (F-factor). Comparison with oxygen-desorption data showed good agreement.

Microfilm $2.85; Xerox $9.80. 220 pages.

THE INFLUENCE OF OXIDES ON THE WETTING OF METALS BY PORCELAIN ENAMEL GLASSES

(L. C. Card No. Mic 58-5442)

Robert Malcolm King, Ph.D.
University of Illinois, 1958

This investigation was concerned with determining the influence of the oxide of a metal on the wetting of the metal by enamel glasses. A special vacuum-tight furnace was constructed so the furnace atmosphere could be rigidly controlled in order to control the formation of oxide. The furnace atmosphere was changed with the aid of a mechanical vacuum pump which evacuated the furnace to 0.005 mm. mercury. A camera with a 160 mm. lens was used to photograph the silhouetted drop of the molten enamel glass. Wetting was assessed by measuring the contact angles of the drop by projecting the negative with a strip film projector.

The wetting of oxidized and non-oxidized iron, copper, Inconel and platinum by ground coat and titanium bearing enamel glasses was studied. By choosing titanium bearing frits containing ten and twenty per cent titania the effect of titania crystals and iron titanate crystals, in the molten enamel glass, on the wetting of iron was observed. The frits used were electrically smelted and calcined to make them moisture free. The metals were oxidized in an air furnace atmosphere during the initial portion of the heating

period. Oxidation was halted by evacuating the furnace and refilling it with a special prepurified nitrogen. The silhouette of the enamel glass sessile drop, formed on the oxidized metal, was photographed at various times after 825° C. was reached with ground coat frit or after 870° C. with titania bearing frit. With annealing gas (5% hydrogen) in the furnace, a non-oxidizing condition was maintained and the sessile drop was photographed in the same manner as with oxidizing conditions.

On non-oxidized iron and copper lower contact angles were observed than might be expected from a comparison with contact angles formed on platinum in nitrogen. These lower contact angles were undoubtedly due to the presence of slight amounts of oxide at the interface formed by a reaction between the metal and some component of the enamel glasses.

The presence of oxide on a metal greatly improves the wetting of the metal by enamel glasses. Ground coat enamel completely wetted oxidized iron and copper. Titania bearing enamel (20% TiO_2) wetted oxidized copper better than oxidized iron, while titania bearing enamel (10% TiO_2) wetted both oxidized iron and copper better than the 20% TiO_2 enamel. It was believed that iron titanate crystals, which were not present in the 10% TiO_2 enamel, hindered the wetting of oxidized iron by the 20% TiO_2 enamel. The wetting of platinum in an air atmosphere could not be explained by oxides as platinum has no oxides which are stable at high temperatures.

The better wetting of oxidized metal might be explained by solution of the oxide from the surface of the metal, forming a high concentration of metal oxide in the molten enamel glass near the interface. This dissolved metal oxide could alter the liquid-solid interfacial tension resulting in the formation of a lower contact angle.

Microfilm $2.00; Xerox $4.40. 85 pages.

BOUNDARY LAYER TECHNIQUES APPLIED TO LIQUID THERMAL DIFFUSION

(L. C. Card No. Mic 58-5294)

Forest Orion Mixon, Ph.D.
University of Delaware, 1958

The boundary-layer concept, familiar in fluid mechanics, has been used to predict operating characteristics of several new types of thermal diffusion equipment designed to take advantage of processes occurring in thin boundary layers next to heated or cooled surfaces. Improvement in both heat requirements and equipment size can result from the use of newly proposed equipment as opposed to conventional equipment. However, the low separations characteristic of boundary-layer devices necessitate cascading for practical applications. This cascading can be accomplished with no loss in efficiency to provide a process yielding large separations at any desired feed rate.

Microfilm $2.95; Xerox $10.20. 227 pages.

RHEOLOGICAL PROPERTIES OF THE CLAY-WATER SYSTEM UNDER PRESSURE

(L. C. Card No. Mic 58-5468)

James Andrew Nelson, Ph.D.
University of Illinois, 1958

Pressure within the clay-water system is induced by the externally applied forces required in ceramic forming processes such as extrusion. Thus it is important to have an understanding of the effect of pressure on the rheological behavior of plastic clay.

Equipment was designed and constructed which made it possible to determine the pressure distribution in plastic clay. Another piece of apparatus was designed and constructed which was found to be satisfactory for determining the forces required to shear plastic clay within its own structure or to bring about slippage or a combination of slippage and shear at a clay-metal interface at varying pressures and speeds.

It was found that when an external pressure was applied to a plastic clay so that within its entire structure stresses existed which exceeded its yield value, then an increase in applied pressure was transmitted in a direct proportion to other points in the plastic clay.

Curves were obtained for Florida kaolin, Fulton plastic fireclay, and Danville shale showing the relationship of the torque required to turn a smooth, metal rod in plastic clay to the clay pressure and speed of rotation of the rod. Similar curves were also obtained where the clay sheared within its own structure instead of at a clay-metal interface. Comparison of the curves for clay of the same consistency was used to indicate the extent of the slippage in the case of the smooth metal rod.

In general, the torque-pressure curves showed an increase in torque until a certain pressure had been reached and then it became practically constant. Torque increased with speed of rotation of the metal rod. When the water content was just sufficient to fill the pores between the clay particles or lower, there was a great variation in the torque with small changes in the amount of water. In comparison, when the water was in excess of that necessary to fill the pores, the torque did not show much variation with large changes in water content.

Additions of round-grain blasting sand (20-40 mesh U. S. Standard screens) to Florida kaolin were shown to increase the torque required to turn a smooth metal rod in plastic clay almost directly proportional to the amount of sand added. Microfilm $2.00; Xerox $5.20. 104 pages.

CERAMIC AND DIELECTRIC PROPERTIES OF LEAD METANIOBATE ELECTRICAL CERAMICS

(L. C. Card No. Mic 58-5469)

Karl E. Nelson, Ph.D.
University of Illinois, 1958

In recent years there has been considerable interest and demand for high-temperature electronic components made from ferroelectric materials useful in a temperature range higher than afforded by barium titanate whose highest Curie temperature is about 120 degrees centigrade.

Because of the inherent operating temperature limitation imposed by ferroelectrics made from barium titanate, a substantial amount of study has been and is presently being devoted to investigating materials which may be used satisfactorily at higher temperatures. The purpose of this investigation was to gain a greater knowledge and better understanding of the ceramic and dielectric properties and behavior of a recently discovered ferroelectric material. The new material is the compound lead metaniobate, $PbNb_2O_6$, formed by reacting one mole of lead oxide with one mole of niobium pentoxide. This compound has a very high Curie temperature, 570 degree centigrade, and a moderately high room temperature dielectric constant, 200 to 300.

The areas which were studied in this investigation may be summarized as follows: 1. Quantity of contamination introduced into barium titanate during wet milling and its effect on the electrical properties as a function of type of grinding medium and length of milling time; 2. Ceramic and dielectric properties of bodies in the $(Pb,Cd)(NbO_3)_2$ system; 3. Feasibility of hot-pressing lead metaniobate ceramics using graphite molds and plungers; 4. Cause and elimination of the formation of a glass-like layer on the surface of lead metaniobate specimens during firing; 5. Ceramic and dielectric properties of bodies in the metal stannate-lead metaniobate binary systems including the stannates of cobalt, strontium, lead, and bismuth at stannate contents of two and five mole per cent; 6. Ceramic and dielectric properties of lead metaniobate including a detailed study of lead oxide loss and fired porosity as a function of firing temperature and firing time, and the effect of these variables on dielectric constant and electrical losses over the temperature range of 25° to 500°C.

From these studies the following general observations were made: 1. Electrical bodies may be contaminated to the extent of 0.20 to 3.30 per cent when wet milling three to twelve hours with alumina and porcelain grinding media; 2. Ceramic bodies in the $(Pb,Cd)(NbO_3)_2$ system have improved temperature coefficients of dielectric constant and lower electrical losses than lead metaniobate alone; 3. Graphite molds and plungers can not be used successfully for hot-pressing lead metaniobate ceramics. The niobium ion reduces to a lower valence state in the presence of a slightly reducing environment; 4. The amount of lead oxide lost by lead metaniobate is a linear function of firing time, and in addition increases rapidly as the firing temperature increases; 5. Slight intentional changes in the equimolar ratio of PbO to Nb_2O_5 or changes resulting from the loss of PbO during firing do not have an appreciable effect on its dielectric constant at the Curie temperature, temperature coefficient of capacitance, or electrical losses; 6. Higher room temperature dielectric constant values and lower dissipation factors above 300°C. result when lead metaniobate is fired at 1300° rather than 1225°C. in spite of the higher porosity associated with the ceramics fired at the higher temperature; 7. A minimum and maximum point exist in the fired porosity curve of lead metaniobate in the temperature range of 1200° to 1350°C.; 8. The porosity of lead metaniobate increases rapidly when fired at temperatures higher than 1225°C. due to excessive crystal growth. Microfilm $2.00; Xerox $5.20. 105 pages.

THE RATE OF HYDROCHLORINATION OF ACETYLENE IN A FIXED CATALYST BED

(L. C. Card No. Mic 58-3207)

Robert Dale Wesselhoft, Ph.D.
Purdue University, 1958

Major Professor: John M. Woods

A study was made of the effect of the partial pressures of acetylene, hydrogen chloride, and vinyl chloride upon the rate of hydrochlorination of acetylene to form vinyl chloride. The rates were determined at temperatures of 167, 212, and 257°F in a fixed bed differential reactor containing 0.020 lb of catalyst, which was 8.7 weight percent mercuric chloride on activated carbon with a pellet size of approximately 0.1 inches. The bed was diluted to approximately one part of active catalyst to sixteen parts of inert packing (porcelain) in order to reduce the temperature gradients. The resulting conversions were in the range of two to three percent vinyl chloride based on the total feed. At simulated higher conversions the rates were determined by injecting vinyl chloride into the feed gas. The product gases were analyzed by means of a thermal conductivity cell.

The average rates were corrected for the small partial pressure and temperature changes and for catalyst activity changes in order to determine the rates at the reactor inlet conditions. The catalyst activity corrections were made by means of runs at standard conditions alternated with the data runs.

The data fitted a rate equation developed by assuming that the rate-controlling step of the postulated reaction mechanism was the surface reaction between adsorbed acetylene and hydrogen chloride. Two types of adsorption sites were assumed - one upon which the acetylene adsorbed, and the second for hydrogen chloride and vinyl chloride. The rate equation was of the form

$$r = \frac{C(P_A P_H - P_{VC}/K)}{(1 + K_A P_A)(1 + K_H P_H + K_{VC} P_{VC})}$$

where the constants at the three temperatures were

	at 167°F	at 212°F	at 257°F
C	0.08	0.14	0.232
K_A	0.58	0.46	0.40
K_H	2.9	2.66	2.5
K_{VC}		3.8	

with the pressures measured in atmospheres, and the rate measured in pound moles of vinyl chloride per pound of catalyst per hour.

Effective values for the activation enthalpy and entropy for the rate constant (C) and for the standard enthalpy and entropy changes for the adsorption of acetylene and hydrogen chloride were calculated. These were for (C)

$\Delta H_A^{\ddagger} = 10{,}520$ Btu/Mole $\quad \Delta S_A^{\ddagger} = 11.81$ Btu/Mole-°F

and for the adsorption processes

	ΔH^0	ΔS^0
Acetylene	-3,680 Btu/Mole	-7.0 Btu/Mole-°F
Hydrogen chloride	-1,560	-0.37

Microfilm $2.10; Xerox $7.40. 157 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

DEVELOPMENT OF CERAMIC USES FOR NEPHELINE SYENITE TAILINGS

(L. C. Card No. Mic 58-3475)

Robert Charles Wilson, Ph.D.
The Ohio State University, 1958

During the beneficiation of nepheline syenite ore, approximately one quarter of the ore is removed as an iron-bearing tailing. In order to improve the economics of the ore processing, it is imperative to develop a use for this iron-bearing product. A high iron flux is not widely usable in the whiteware field because of color. However, in the structural clay field the red color imparted by iron in the flux would not be detrimental. In this study, the iron-bearing tailings were incorporated in the formulation of various sewer pipe bodies and glazes. All such bodies and glazes were prepared by conventional methods. The addition of ground nepheline syenite tailings improved the physical properties of fire clay and shale pipe bodies maturing at or above cone 02. In bodies that matured below cone 02, the fired physical properties were not affected, but the unfired physical properties were improved. Non-fritted and fritted glazes for sewer pipe application maturing in the cone 4 and cone 04 ranges were developed. The non-fritted glazes were based on a low fusion mixture of nepheline syenite tailings, talc, and Gerstley Borate. Small percentage additions of chromic oxide were helpful in stablizing the colors and in simulating the appearance of a typical salt glaze. Lead-boro-silicate and lead silicate frits were used in the fritted glazes. For both the cone 4 and cone 04 glazes, the fritted glazes evidenced the highest increase in flexural strengths.

Microfilm $2.00; Xerox $4.20. 79 pages.

ENGINEERING, CIVIL

STRENGTH OF PRESTRESSED CONCRETE BEAMS WITH WEB REINFORCEMENT

(L. C. Card No. Mic 58-5430)

Gregorio Hernández Concepción, Ph.D.
University of Illinois, 1958

Outline of Investigation

The purpose of this investigation was to study the behavior of prestressed concrete I-beams with web reinforcement, with special attention to the influence of the web reinforcement on the mode of failure. In total, 38 beams with overall cross-sectional dimensions of 6 by 12 in. were tested. All the beams had webs either 1 3/4 in. or 3 in. thick. Two beams had cast-inplace slabs 2 in. thick and 24 in. wide. The concrete strength varied from 2310 to 5520 psi, being about 3000 psi for most of the specimens. Two longitudinal reinforcement ratios were used, either 0.00192 or 0.00400, and the nominal prestress was kept at 120,000 psi for all the beams. Vertical stirrups were used in all beams, with the ratio, based on web thickness and effective depth, varying from 0.00098 to 0.0135. The stirrup spacing varied from 2.5 to 10 in. All beams had symmetrically placed concentrated loads, the shear spans ranging from 28 to 54 in.

Web reinforcement proved to be a suitable means of improving the behavior of the beams failing in shear, and of preventing shear failures if used in proper amounts. From studies of the data, a hypothesis for the mechanism of failure was developed.

Behavior of Test Beams

Of the 38 beams tested, 11 failed in shear, 23 in flexure, and 4 in a "transition" failure. Before cracking, all beams behaved "elastically" and similarly. After the first flexural cracks, the stiffness was appreciably reduced but the beams still behaved rather elastically until the formation of inclined cracks or the development of long flexural cracks. Before the formation of inclined cracks, it was considered that the stresses in the stirrups were negligible. After inclined cracking the stirrups prevented the opening of the cracks and immediate failure. As the load was increased, the stirrups either yielded or fractured and a shear failure took place or they were capable of preventing this and the beam failed in flexure.

Beams failed in shear in several different ways: (1) by crushing of the compression zone above the end of one of the inclined cracks, similar to a flexural failure; (2) by crushing of the web, due to the thrust induced by arch action; or (3) by general distortion of the web, usually accompanied by tension cracks in the top flange and fracture of the stirrups.

In general, shear failures were violent, although in most cases the beam reached a deflection and carried a load comparable to those of the beams which failed in flexure.

Test Results

An empirical expression for the amount of stirrups required to prevent shear failures was derived from the test data. For the range of variables used, this amount was found to be proportional to the difference between the shear at inclined cracking and the ultimate shear. With this expression it was possible to predict the mode of failure of all the beams except one, and it was also used to predict conservatively the strength of the beams which failed in shear. The average ratio of the measured to computed strengths of the beams which failed in shear was 1.04, and the mean deviation 0.043.

In summary, it was found that, at least for the cases covered in this investigation, it was possible to prevent shear failures by using adequate amounts of vertical stirrups, and that even a small amount of web reinforcement improved considerably the behavior and load carrying capacity of a beam. If a beam fails in shear, but the amount of web reinforcement is not much less than that required for a flexural failure, the behavior and strength of the beam are practically equal to those of a similar beam failing in flexure. Therefore, a beam should have enough web reinforcement either to fail in flexure or to have a "desirable" shear failure in order to utilize its optimum strength.

Microfilm $2.00; Xerox $6.80. 145 pages.

A STUDY OF THE MINIMUM-WEIGHT PROPORTIONS FOR A DOUBLE-CANTILEVER TRUSSED ROOF SYSTEM

(L. C. Card No. Mic 58-5421)

Gordon Miles Gray, Ph.D.
University of Illinois, 1958

A rapid increase in demand for large aircraft hangers has given the structural engineer insufficient time to accumulate data and experience in proportioning this type of structure. A major drawback to the designer has been the ponderous methods of hand calculation used in most structural analyses.

This thesis undertakes the development and use of a procedure for structural design by high-speed electronic computer. The procedure is applied to the determination of least-weight proportions for one type of trussed cantilever roof system. The type of structure considered is made up of double-cantilever main trusses having a central aisle span of 35% of the overall width. Longitudinal secondary trusses span between the main trusses at panel points, and purlins span between secondary trusses at panel points. Both main and secondary trusses are designed with tension diagonals, and fabrication is considered to be by welding throughout.

The proportions which were allowed to vary in arriving at a least-weight configuration were:

Purlin size
Secondary truss depth and number of panels
Cantilever truss depth and number of panels
Number of panels in central truss
Spacing between main trusses

Least-weight roof system proportions were found for each combination of the following design conditions:

Cantilever span (ft.): 60, 80, 100, 120, 140, 160, 180.
Roof load (psf): 40, 80, 120.
Canopy door load (psf): 0, 20.
Horizontal wind load (psf): 0, 12, 40.

In Chapter II mathematical expressions for stress in the truss members are developed. These expressions are in a repetitive form which is convenient for use with the computer. Also developed in this chapter are expressions, in terms of truss member weight, for the American Institute of Steel Construction specification requirements which governed the design. The specification conditions are satisfied in the computer by calculating and comparing weights and selecting the largest for each truss member.

The interpretation of computer output data is presented in Chapter III as a series of graphs and charts showing the interaction of truss proportions for all of the design conditions considered. It was found that the truss depths, panel lengths and spacing between main trusses were much larger than are common in existing structures. Example: For a minimum-weight roof system having 140-foot cantilevers, a 40-psf roof load and no canopy door, the main truss depth, using 9 panels in the cantilever trusses and 4 panels in the central truss, was 47 feet. The spacing between main trusses for this case was 79 feet, and the total weight per linear foot of roof structure (excluding the weight of roof surfacing) was 4.8 kips per foot.

While the computer program used in this study was coded specifically for the ILLIAC computer at the University of Illinois, it can be used (after translation) on the IBM 650 or other commercial computers of equivalent memory storage capacity. The program is also flexible, being suitable for adaptation to a variety of uses in the study of truss proportions. It is believed that the results of this study can give the engineer an insight into the variation of proportions of the type of structure investigated, for different conditions of loading, which he could otherwise gain only through years of design experience.

Microfilm $2.00; Xerox $5.80. 119 pages.

WARPING STRESSES AND DEFLECTIONS IN CONCRETE SLABS

(L. C. Card No. Mic 58-3163)

Milton Edward Harr, Ph.D.
Purdue University, 1958

Major Professor: G. A. Leonards

A theory has been developed whereby the stresses, deflections, and degree of support of concrete slabs on ground, subject to ambient temperature and moisture gradients, can be computed for finite slab sizes.

Solutions to the resulting equations were programmed for the Datatron 204 digital computer at Purdue University. As a part of the solution, subroutines were developed for the Ber and Bei functions and their first derivatives.

Nomographs are presented which give ratios of the critical stress to the modulus of rupture for a wide range of environmental gradients, and for various combinations of slab sizes and thicknesses. For slab sizes and equivalent temperature gradients that comply with Westergaard's assumptions of a fully supported slab, computed stresses and deflections check those obtained by the Westergaard theory. However, the maximum gradients for which the Westergaard theory was found to be applicable are very much lower than those commonly encountered in practice. The new theory is capable of accounting for the more critical conditions, which develop when the slab is only partially supported.

Conclusive evidence regarding the reliability of the derived theory is not available at this time. However, comparisons between computed deflections and available measured deflections strongly indicate that the theory is applicable to concrete highway pavements not subject to superimposed traffic loads.

Although many factors, such as aggregates, water-cement ratios, curing, carbonation, etc., affect the moisture content-volume change relationship, the available data indicate that combined temperature and moisture gradients encountered in practice are capable of producing tensile stresses which exceed the modulus of rupture of concrete. In the critical shrinkage range, a moisture gradient of one percent can cause warping equivalent to a 20 degree F. difference in temperature between slab surfaces. Accordingly, cracking may occur at small temperature gradients if moisture differences between slab surfaces are only a few percent.

The concepts developed in this study can provide the basis for the solution of a number of problems involving warping of slabs; for example, "slab on ground" construction for homes, icing of lakes, and the like.

Microfilm $2.00; Xerox $5.40. 109 pages.

A STUDY OF THE EFFECT OF CRACK WIDTH AT TILE JOINTS ON SOIL MOVEMENT INTO DRAIN TILE LINES

(L. C. Card No. Mic 58-5439)

Benjamin Angus Jones, Jr., Ph.D.
University of Illinois, 1958

A large percentage of the agricultural land of the United States would not be productive without drainage. A majority of this drainage is tile drainage which requires an annual investment of $21 million for drainage enterprise work. It is estimated that, in addition, farmers and landowners invest an equal amount to improve their own drainage systems.

Partial or complete failure of drain tile lines may be caused by the development of sinkholes over the tile and the subsequent deposition of soil in the tile. Field investigation has shown that the apparent cause of sinkholes at tile joints is excessive crack width. Often the crack width to be used upon installation of tile drains is not specified and if it is, it is based upon experience, not upon test results.

A laboratory device was constructed and tests were conducted to study the effect of crack width at tile joints upon the quantity of soil moved into tile drains. The tests were made using a 2-inch inside and a 2 1/2-inch outside diameter tube packed in the center of a soil profile tank. Three tube joints were located in the profile tank. Three sizes of crack width were used and tested with a sandy loam, a silt loam, and a silty-clay loam soil.

The soil was kept saturated by ponding water on the surface while the profile was allowed to drain. In addition, water was circulated through the drain tube from an external water system to simulate water coming from upper parts of a tile drainage system. The tile outflow was caught, soil particles settled, dried, and weighed. Piezometer tubes were located in the profile to determine equipotential lines in the soil and manometer points were located in the drain tube to measure disturbance near the joints.

Tests with the sandy loam soil were unsatisfactory since the soil moved into any sized crack width. Tests with the silt loam soil and a free outlet at the tube showed that a change from 1/16- to 1/8-inch crack width increased the soil discharged 4.4 times. Changes from 1/8- to 3/16-inch crack width and 1/16- to 3/16-inch crack width increased the soil discharged 2.3 and 10.2 times respectively. If a submerged outlet condition existed instead of a free outlet, the soil discharged increased about 50 percent regardless of crack width.

Tests with the silty-clay loam soil showed that with free outlet conditions a 1/8-inch crack admitted 1.3 times and a 3/16-inch crack width 9.8 times more soil than a 1/16-inch crack width. A change from 1/8- to 3/16-inch crack increased the quantity of soil discharged 7.9 times. A submerged outlet condition increased the soil discharged about 60 percent regardless of the size of the crack.

Since an increase in crack width from 1/16 to 1/8 inch, or 1/8 to 3/16 inch increases inflow at the tile joint only about 10 percent, crack widths should be limited in these soils to 1/16 inch for the silt loam and 1/8 inch for the silty-clay loam.

Microfilm $2.00; Xerox $6.80. 144 pages.

SURFACE RUNOFF IN THE GULF COAST AREA IN RELATION TO SOLAR ACTIVITY

(L. C. Card No. Mic 58-3990)

Carl William Morgan, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Walter L. Moore

The sun is the prime source of energy for the earth and transmits its energy to the earth in various forms. Diurnal and seasonal changes in the energy received at various points on the earth are known to influence atmospheric circulation, cloud and rain formation, and runoff from streams. It is reasonable to suppose that long-period changes in solar activity may also influence atmospheric circulation and consequently stream flow.

A study was made of the variations of the sun's activity that have been observed and how these variations might affect the runoff in streams. The solar variations considered were sunspots, faculae, flares, prominences, centers of activity and the solar constant. A literature search was made to find what results had been obtained in correlating solar variations with terrestrial magnetic activity, surface temperature, surface air pressure, changes in the general circulation, and surface runoff.

Surface runoff was studied in the area of the lower Mississippi basin, and in the basins of other rivers emptying directly into the Gulf of Mexico. This area was chosen since it has as its source of moisture the flow of surface air that originates over the Gulf of Mexico. It was felt that a study of this area should indicate whether or not the pattern of the moisture bearing winds changed with time and whether or not there was a change in the distance the moisture was carried from its source before precipitation occurred.

For each stream, the ratio of the yearly runoff Q to the mean yearly runoff $\bar{Q}$ for the period of record was used for all calculations. Thus widely varying annual runoff values could be reduced to a more comparable basis. A three-year moving average of $Q/\bar{Q}$ was plotted on a map of the area for each even numbered year from 1928 to 1954. Lines connecting points of equal relative runoff $Q/\bar{Q}$ were drawn, giving a graphical representation of the location of areas of runoff excess and deficiency. Each such plot indicated a systematic rather than random change throughout the area. When these plots are viewed in succession they show the movement of areas of rainfall excess and deficiency with time. A plot showing the movement of the centers of excess and deficiency with time indicates a definite systematic trend. The plot of deficiencies indicates that, for the last four years of available data, the centers of runoff deficiency are following approximately in the path of those some 22 to 24 years previous.

The relative runoff values $Q/\bar{Q}$ for each year were correlated with the sunspot numbers for each year. The sunspot number was used as the best measure of solar activity available. Correlation coefficients ranged from -0.08 to +0.57. The higher coefficients were in the states of Alabama, Mississippi and Georgia, whereas the lowest coefficients were in Texas. When values of $Q/\bar{Q}$ were correlated with the sunspot numbers several years previous, a systematic change in the correlation coefficient was

obtained for different periods of lag. Zero correlations which were obtained for some streams with no lag period were changed to -0.5 upon introducing a suitable lag period.

Correlation of $Q/\overline{Q}$ with the double sunspot cycle in which alternate cycles were assumed negative gave improved values of the correlation coefficient as compared with those obtained from the conventional 11-year sunspot cycle. Microfilm $2.00; Xerox $5.20. 105 pages.

ENGINEERING, ELECTRICAL

THE EFFICIENCY OF EXCITATION OF A SURFACE WAVE ON A DIELECTRIC CYLINDER

(L. C. Card No. Mic 58-5409)

James Wilbur Duncan, Ph.D.
University of Illinois, 1958

This paper treats the excitation of a transverse magnetic surface wave on a dielectric cylinder. Specifically, the efficiency with which a circular filament of magnetic current excites the E_{01} mode on an infinite, dielectric rod is determined. The E_{01} mode is the lowest order, transverse magnetic mode which can propagate on a dielectric rod. The excitation efficiency of a source is defined as the ratio of the power converted to the surface wave mode to the total power which is delivered by the source.

The solution for the field generated by the magnetic current filament is obtained in the form of an inverse Fourier transform. The integral is evaluated by considering it as a contour integral in the plane of the complex propagation constant. The far zone radiation field of the source is obtained from the asymptotic evaluation of the integral by means of the saddle point method of integration. The poles of the integrand yield the TM surface wave modes, which are all circularly symmetric. By restricting the range of k_0b, which is the circumference of the dielectric rod in wavelengths, it is assured that only the E_{01} mode is launched by the source. Curves are presented which show excitation efficiency as a function of k_0a, the circumferential length of the filament. It is found that a filament of the proper diameter will excite the E_{01} mode with an efficiency of approximately 95 percent.

In the laboratory, a very narrow, annular slot in a large metal sheet was used to approximate the magnetic current filament. The excitation efficiency of the slot was measured using Deschamps' method for calibrating a two-part waveguide junction. The measured efficiencies are in close agreement with the results predicted by the theory.

Microfilm $2.00; Xerox $5.80. 118 pages.

AN INCLUSIVE DETERMINATION OF HIDDEN PHENOMENA IN, AND STABILITY CRITERIA OF, SAMPLED-DATA SYSTEMS

(L. C. Card No. Mic 58-5343)

Robert William Greer, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor T. J. Higgins

The purpose of this thesis is threefold:

1. To advance theory enabling inclusive determination of the nature of the stability of sampled-data systems.
2. To formulate theory enabling determination of the nature of the system response between sampling instants: that is, whether or not "hidden" phenomena exist.
3. To formulate analysis enabling proper and inclusive determination of the "hidden" phenomena if such exist, as revealed by the method of item 2.

An exhaustive, detailed study of essentially all of the literature on sampled-data systems [in published papers and in accessible company reports and college theses] reveals that one of the more difficult, yet unsolved problems of the theory is that of correct determination of the possible existence of "hidden" phenomena. "Hidden" phenomena, as illustrated in the thesis through use of specific examples typical of those encountered in practice, comprise undesirable oscillations in the response. As those few references to "hidden" phenomena that do appear in the present literature merely mention their possible existence, it is obviously of considerable practical importance to solve the above-mentioned problem. Pertinently linked with the solution to this problem are formulations of theory enabling inclusive determination of the nature of the stability and of the total response of the system.

A stability procedure applicable for one structure of sampled-data system, or for determination of a particular nature of stability, may not be well-applicable or may be very ill-suited for use with a different structure of system. Accordingly, it is most desirable to have a full delineation of possible stability techniques for determining the nature of the stability. The new investigative techniques formulated in this thesis now enable as flexible and exhaustive analysis of sampled-data systems as is possible for continuous system analysis.

The essential content of the thesis is as follows.

Chapter 2 comprises a concise account of the development of sampled-data system analysis, as effected by use of z-transform and modified z-transform analysis.

Chapter 3 advances an account and extension of the known aspects of z-transform and modified z-transform theory.

Chapter 4 comprises discussion of the general aspects of determination of the nature of the stability of sampled-data systems and extension of the present limited body of available theory to an extent evidenced in eventual statement of eleven stability criteria.

Chapter 5 advances a detailed examination of determination of the possible existence of "hidden" phenomena. Criteria enabling determination of whether or not "hidden" phenomena do exist in a given system are formulated. The different types of phenomena and the corresponding different necessary analytical techniques that must be employed are determined by these criteria.

Chapter 6 summarizes the essential values stemming from the work of this thesis.

Appendices I, II, and III comprise transform tables and other auxiliaries.

The Bibliography advances an inclusive up-to-date listing of the published papers and books, and of available reports and theses, on sampled-data system analysis.

Microfilm $2.00; Xerox $5.60. 115 pages.

THE TIME ELEMENT IN PHOTOELECTRIC EMISSION

(L. C. Card No. Mic 58-5435)

Don Franklin Holshouser, Ph.D.
University of Illinois, 1958

A measurement of the photoelectric response of transmission-type cesium-antimonide photocathodes to light pulses of 170 micromicrosecond duration is obtained by modulating the light from a xenon flash tube, type FX12, with a specially designed Kerr cell shutter driven by pulsed 3 kmc/s microwave power. The degree of modulation of the photoelectric emission produced in a type 1P42 phototube by the modulated light is obtained by using the photoelectron current to generate microwave power in a resonant cavity whose output can be measured.

The Kerr cell used is part of a resonant system, the Kerr cavity, in which very high electrostatic and microwave fields, approaching 10^8 volts per meter, are superimposed. The Kerr cell liquid is carbon-disulphide. The design of the cell is such that the transit angle of the light, relative to the microwave period, in passing through the fields of the Kerr cell is π radians. The peak-to-peak amplitude of modulation of the light, as obtained from measurements of the change in average light, is as high as 80 per cent of the maximum light transmission. The Kerr cavity is driven by one microsecond microwave pulses at a repetition frequency of 120 c/s, synchronized with the light flashes from the lamp.

The photoelectric detection system consists of a cavity, resonant at the Kerr cavity frequency, in which the gap is formed by the anode-cathode region of a 1P42 phototube. The gap spacing is sufficiently small so that the coupling coefficient for the photoelectrons in transit across the gap is near unity. A photoelectron current, modulated at the resonant frequency, delivers microwave power to the system proportional to the square of the amplitude of the microwave component of the photoelectron current and proportional to the shunt resistance of the gap. The average photoelectron current, while the phototube is illuminated by the one microsecond flashes of microwave modulated light, is around 50 microamperes, about one hundred times that normal for the 1P42 in steady light operation. The microwave power of the phototube cavity is coupled out, detected, preamplified, and observed on an oscilloscope. Calibration of the over-all system is achieved by exciting the phototube cavity with an auxiliary coupling loop with known levels of microwave power.

If the photoelectric response time were small compared to the duration of the light pulses, then the microwave power to be expected from the phototube cavity in the system just described would be several microwatts. A much smaller power was actually obtained in the experiment--less than 0.1 microwatt. Assuming the photoelectron emission induced by light quanta follows an exponential-decay behavior with time constant τ, then the measurements made indicate a value for τ of about one millimicrosecond.

Microfilm $2.00; Xerox $5.00. 100 pages.

NONLINEAR DIFFERENTIATING FILTERS

(L. C. Card No. Mic 58-3168)

Jack Ellsworth Kemmerly, Ph.D.
Purdue University, 1958

Major Professor: George R. Cooper

A network is to be devised which will differentiate a nonstationary electrical signal which is expressable as a first-degree polynomial in time. Since the incoming signal is mixed with a zero-mean Gaussian noise, the network must filter out as much of the noise as possible, and also keep the settling time of the filter small.

The input signal-plus-noise is first examined from the standpoint of its information content to determine an expression for the minimum time required to estimate the derivative of the signal with a prescribed accuracy. Two "optimum" linear filters are then analyzed to obtain a relationship between settling time and rms noise output. The results indicate that the settling times for these linear filters are much greater than the theoretical minimum, and suggest that some improvement in settling time might be obtained by using a nonlinear differentiating filter.

Two nonlinear filters, using negative feedback, are then considered. They incorporate a so-called infinite clipper and an idealized symmetrical clipper containing a dead zone. The statistical properties of the outputs of these two nonlinearities are then described, and it is shown that the mean value of the output can be made directly proportional to the mean value of the input under certain conditions. The autocorrelation functions of the outputs are also derived.

The first nonlinear filter which is analyzed is a single-stage device which uses a simple RC differentiating network, followed by an infinite clipper and a simple RC smoothing filter. Negative feedback is used around the clipper and smoothing filter to insure that the filter output is always directly proportional to the derivative of the input signal. It is found, however, that the noise reduction obtained from such a device is rather poor compared with linear filters.

Next, an analysis is made of a two-stage nonlinear filter made up of a simple RC differentiating network followed, successively, by an idealized dead-zone symmetrical clipper, a lead network, and a simple RC smoothing filter. This filter uses the same type of feedback that was used in the single-stage case. It is found that the two-stage nonlinear filter is capable of a great amount of noise reduction and a small settling time, especially if the input signal-to-noise ratio is small.

Along with the general theoretical analyses, numerical examples are included which describe the behavior of each of the filters which is discussed. Graphs of output noise-versus-settling time are included for each of the filters.

Microfilm $2.00; Xerox $4.60. 90 pages.

POLE-ZERO SENSITIVITY IN NETWORK FUNCTIONS

(L. C. Card No. Mic 58-5444)

Franklin Kuo, Ph.D.
University of Illinois, 1958

If a network contains a variable parameter x (capacitance, or g_m of a vacuum tube, etc.), the polynomials of the driving-point and transfer functions describing the network have coefficients which are linear functions of x. The roots of the polynomials are also functions of x. Since the locations of the poles and zeros of these network functions are important in both analysis and synthesis of the network, it is desirable to know quantitatively the tendency for a root to vary with the parameter x. A measure of this tendency to vary is provided by the sensitivity function $S = dp/dx$, where p is a root of a polynomial. Properties and theorems pertaining to this sensitivity function are given in this thesis.

Root sensitivity and the root locus of the polynomial are closely related topics. Sensitivity is shown to be residue of a pole of a specialized form of the root locus equation whose poles are the roots of the given polynomial. From the properties of this special root locus form, it is shown that intersections of root loci have infinite sensitivities. Other cases of infinite sensitivity figures are studied. The sum of the sensitivities of the roots of any polynomial is derived, and some properties are given as related to certain defined classes of polynomials. Numerical examples computed on ILLIAC are given to illustrate sensitivity properties of representative root loci.

The sensitivity properties described above are applied to the analysis and synthesis of RC networks. In network analysis, several theorems pertaining to the sensitivity of double zeros of transmission and to a class of insensitive elements are given. The sensitivity factor is introduced in the synthesis of RC ladder networks by the Cauer procedure. Several sensitivity criteria are given for the synthesis of RC ladder networks. Finally, a study is made of certain sensitivity properties of close-loop feed-back networks. A number of suggested problems for further study are given. Microfilm $2.00; Xerox $4.60. 86 pages.

ON THE SELF ORGANIZING AUTOMATA

(L. C. Card No. Mic 58-5355)

Harold Joseph Kushner, Ph.D.
The University of Wisconsin, 1958

Supervisor: Assistant Professor John Asmuth

This thesis is divided into sections that tend in a more or less heurestic manner to discuss problems involved in the theory of non-determinate self organizing goal oriented machines. Solutions or approaches to solutions to some of these problems are given.

Our automata consist of networks of neuron-like elements. The initial properties are of two types. Some are known only through distribution functions. Upon this randomness is superimposed a deterministic structure. The key to versatility and ultimate convergence of behavior lies within that structure.

Suitably chosen distribution functions can yield (without much determinism) networks with certain interesting properties such as localization of activity. This localization can be taken advantage of in the organization of the network as the concentrated activity will hasten whatever alterations occur.

To allow for learning two types of alterations are admitted; the change of interelement connections and the weights of interelement connections. Schedules for these alterations depend on the specific problem considered. The alterations are a function of the part played by the altered parameter in previous activity. The criteria for and the means of making such changes necessitate the determinism. The sequences of the alterable parameters form a Markoff process.

To circumvent the problem of perception, or discovery of invariants over a set of inputs in a general environment we postulate that each input situation is completely determined by a set of given cues. These cues are either continuous or Boolean variables. They represent the logical primitives at the disposal of the automaton.

This in effect assumes that some sort of perception has already taken place. Networks with appropriate distribution functions can be used to perform types of abstraction on the environment. These systems are called stochastic operators.

Upon learning (or reaching a higher degree of organization with respect to the goal responses) the automaton becomes a correlator. The degree of similarity between patterns it was trained to recognize is the basis of "expectation". Patterns not involved in the training procedure are classified (with respect to response) according to a schedule that depends on the specific design. On this basis the machine performs acts of induction.

Several examples of the self organizing system are given and studies of the convergence of their behavior to the desired type are made. The most complicated example involves several interacting networks; the parameters of the interaction are changed through learning. Interaction of inputs with residual activity from past inputs is allowed. Some of the resulting behavioral properties are analogous to the psychological concepts of set and attention.

A mathematical framework is provided for purposes of block diagram representation. We break the device up into two vectors (the state vector and parameter vector) and a transformation (which is to operate on the parameter vector). This breakdown is convenient for analysis but is not a physical construction representation.

The philosophy concerning errors is twofold. At times a single error is inconsequential as no cycling of activity occurs. In more complicated systems there is no dependence on absolute levels or states of activity as some variability is allowed. There are many paths or parts contributing to an action. Each one carries a small part of the requisite information thus making negligible dependency on any one part.

Microfilm $2.05; Xerox $7.40. 156 pages.

A STATISTICAL APPROACH TO THE TOLERANCE PROBLEM IN DESIGN

(L. C. Card No. Mic 58-5446)

Gene Howard Leichner, Ph.D.
University of Illinois, 1958

The problem of designing devices using components which are subject to tolerances or variations is considered. A general approach is used which is applicable to the design of a wide variety of devices in addition to electrical circuits. The synthesis problem is considered to the extent that the configuration is usually fixed, although it is obvious that a limited number of different configurations could be considered simultaneously. The procedures are intended for use by an automatic digital computer since they require extensive computation.

Rather than use the "worst case" philosophy now common in computer circuit design, a statistical approach is used. The purpose of the design procedure is to maximize the probability that a finished unit will perform satisfactorily. It is not intended, therefore, that all of the finished units operate as required. The designer can, by using the design methods described, determine the proper economic balance between the number of rejected units and the required precision of the components.

In order to take advantage of the fact that not all component tolerances are equally likely, the method uses the actual tolerance distributions. A statistical sampling procedure, in accordance with these distributions, is then carried out to evaluate the performance of a set of trial designs. By repeated evaluation of sets of trial designs, chosen at random according to a set of rules, the process is made to converge to an optimum design which has the maximum probability of satisfactory performance.

The design procedure, as outlined for a digital computer, requires that the designer provide the tolerance density functions and a sub-program which evaluates the performance of a design with a given set of component values, i.e. nominal values with tolerances. The latter program contains all the information as to what is being designed, in the form of performance equations and specification limits. The main program, then, provides various sets of nominal values and tolerances for evaluation, and proceeds, guided by the information obtained from the sub-program, toward an optimum design.

Three sample problems -- two parallel resistors, a transistor inverter amplifier and a d-c generator -- are presented to illustrate the methods.

The advantages gained by the design method with its use of statistical methods are as follows:

1) For a given configuration and component distributions the procedure determines the component nominal values which maximize the proportion of satisfactory units. Therefore, when several configurations or component tolerance situations are compared, the best design for each can be used.

2) The procedure is quite general and flexible. The main part of the computer program does not depend on what is being designed. Only one sub-program need be changed to design a completely different device. Many different statistical procedures could be used for increased efficiency with the same over-all structure of the program.

3) The tolerance distributions are arbitrary. The designer provides sub-programs to produce any desired density functions so no assumptions are necessary for the procedure itself. In particular the tolerances need not be normally distributed.

4) Extensive analytic work is avoided. The designer does not have to derive any equations between component values to represent limiting conditions. Instead, the performance quantities are evaluated by a sub-program which he must prepare. These quantities are usually determined from equations with which the designer is quite familiar since they are those of analysis rather than synthesis.

5) No particular insight into the design configuration is required. The designer is not required to determine any worst case situations or to determine to which components the performance quantities are most sensitive.

Microfilm $2.00; Xerox $4.00. 74 pages.

THE APPLICATION OF MATHEMATICAL LOGIC TO NETWORK THEORY

(L. C. Card No. Mic 58-5452)

Wataru Mayeda, Ph.D.
University of Illinois, 1958

Two modern techniques greatly simplify the analysis of networks. One is the use of the signal flow graph from which network functions can be calculated. The other is the use of topological formulas from which network functions are formed directly from network geometry. This work presents a new technique which is the outgrowth of research in network topology.

The set consisting of $y_1, y_2, \ldots, y_k$ is called a circuit set if the elements $y_1, y_2, \ldots, y_k$ form a circuit in a network. A large number of circuit sets can be formed by the elements in a network, but there exist exactly e-v+1 linearly independent circuit sets in a network having e elements and v vertices.

The set consisting of the elements $y_a, y_b, \ldots, y_p$ is called a path set if $y_a, y_b, \ldots, y_p$ form a path between the vertices i and j in a network. If P_1 and P_2 are path sets between the vertices i and j in a network, then $P_1 + P_2$ is a circuit set where + represents the operation called the ring sum. Hence, there exist, at most, e-v+2 linearly independent path sets between the vertices i and j in a network.

If $P_1, P_2, \ldots, P_m$ are all the possible sets, each of which is either a path set between i and j, a circuit set, or a union of sets consisting of one path set and circuit sets in a network, then there exist exactly e-v+2 linearly independent sets in $P_1, P_2, \ldots, P_m$. By knowing these e-v+2 linearly independent sets, the driving point functions of a network can be easily formed. Also, the synthesis of all possible networks satisfying the given sets representing all terms in the numerator or the denominator of a driving point impedance (admittance) function can be accomplished. This technique can be extended to form transfer functions of a network.

A switching function consists of terms each of which is

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

a set of elements representing a condition for transferring a signal from one vertex to the other. On the other hand, a path set consists of elements which join the vertex i and the vertex j. Hence, a switching function can be considered as a group of path sets between the vertices i and j. Thus, the analysis and the synthesis of multiple-contacts-relay networks can be accomplished by the application of the theory described.

Microfilm $2.00; Xerox $4.00. 73 pages.

AN INVESTIGATION OF TIME-CONSTANT VALUES IN THE DESIGN OF TWO-PHASE SERVOMOTORS

(L. C. Card No. Mic 58-3196)

Austin Linn Shelley, Ph.D.
Purdue University, 1958

Major Professor: E. M. Sabbagh

Electric servomotor design is largely a trial-and-error procedure. Before a motor can be designed, the required performance or response must be specified. For a given set of specifications, the engineer makes a guess at the solution by using a combination of curves, rules, and experience. This "guess" must lead to the determination of the component values. The "design" is then verified by a paper analysis, in special cases, or by the construction of a pilot model. If the "design" meets the original requirements, a solution has been obtained but there is no assurance that this is the best solution. The object of this research is to see if certain information, in the form of time-constant values or ranges of time-constant values, can be useful for predicting motor response. This would relieve the design engineer of much of the guesswork involved in meeting a given set of response requirements.

The works of Stanley* and Sabbagh** provide the starting point of this investigation. Stanley's generalizations, as applied to the two-phase induction motor, of "Park's equations" and Sabbagh's subsequent observations of the similarity of results, with only minor adjustments to the assumptions, between the 2-reaction theory and the cross-field theory for the calculation of the performance of a-c machines. These works have indicated a fresh approach to the design of motors, particularly those for closed cycle control system applications.

The impossibility of a complete evaluation and solution of Stanley's equations for the motor transient response is demonstrated. This failure is due mainly to the mathematical complexity which is involved in the solution of a set of simultaneous nonlinear differential equations subject to arbitrary boundary conditions. Analytical solutions for the two simplest cases, namely, the blocked-rotor condition and the steady-state condition, are shown as a demonstration of the utter futility of obtaining a general solution before proceeding to an analog computer study of the equations describing motor performance.

High speed performance of a servomechanical system requires that the drive or control motor come up to speed in as short a time as possible. The emphasis throughout this investigation is, therefore, on speed of response as measured in terms of rise time for suddenly applied voltages. At the same time other desirable features of motor performance are not subordinated. A close check is maintained on the corresponding values of overshoot and settling time as the motor parameters are varied to attain the best response possible.

A wide variety of curves illustrating the effect of the variation of all important motor time constants and parameters upon the response are included. These allow the designer a maximum of flexibility in the selection of initial values from which to work. The time variation of rotor and stator currents for certain time-constant values are also included.

The time-constant method of predicting motor performance provides a simple, yet flexible, method for accurately selecting the parametric values of a servomotor to meet required response specifications. The motor designed by this method should exhibit satisfactory response characteristics over the expected range of inputs and the overall system response should be accurately realized.

Microfilm $2.00; Xerox $6.80. 143 pages.

*Stanley, H. C., "An Analysis of the Induction Motor," AIEE Transactions, Vol. 57, 1938, pp. 751-5.

**Sabbagh, E. M., "Application of the 2-Reaction Theory to Electric Motors," AIEE Transactions, Vol. 70, 1951, pp. 1748-56.

PIEZOELECTRIC AND MAGNETOSTRICTIVE TRANSDUCERS

(L. C. Card No. Mic 58-5501)

Stephen Whittier Tehon, Ph.D.
University of Illinois, 1958

Thin bar piezoelectric and magnetostrictive ceramic transducers can be assembled end-to-end into a number of different composite bars which have useful properties as linear electric circuit transmission devices. Input electrical energy is converted by electromechanical coupling into longitudinal vibrations which traverse the composite bar and are reconverted to output electrical energy. Frequency response is dependent on mechanical resonances of the bar and on coupling with the input and output electrical circuits.

Analysis of these thin bar devices necessarily involves a study of the mechanical, electrical, and electromechanical properties of the ceramic materials. The general theories pertaining to elasticity, anisotropic dielectric media, piezoelectricity, magnetostriction, and reciprocity are extended to consider media with internal losses and hysteresis, and are specialized for ceramic materials which all display polar anisotropy when in a polarized state.

Basic thin bar ceramic elements, subjected to arbitrary electrical and mechanical signals, can be analyzed under the assumptions of linearity by means of the stress equations of motion and the general electromechanical properties, with appropriate boundary conditions. By the use of electromechanical analogies, equivalent circuits representing these solutions are drawn for the side plated piezoelectric bar, the end plated piezoelectric bar, and the magnetostrictive bar.

Conventionally, piezoelectric devices require one

possible analogy and magnetostrictive devices require the dual of this analogy. With the ideal gyrator as a circuit element, equivalent circuits for both types of devices can be drawn with the use of a single analogy without recourse to the dual. In that analogy, the mechanical bar properties always appear in the same form, which is defined here as the general mechanical equivalent circuit.

The analysis of thin bar systems proceeds by application of four terminal network theory to the derived equivalent circuits. Simplified methods for numerical computation are derived, and the particular case of ceramic transformers having mechanical symmetry is reduced in detail to simple form. Graphical methods employing circle diagrams are developed for the purposes of determining the frequency response analytically and for evaluating material properties from electrical frequency response measurements. Tabulations are given of all piezoelectric and magnetostrictive equations in matrix form, of their coefficients appropriate to ceramic materials, and of the interrelations between these coefficients for the different mathematical formulations in use.

An experimental electromechanical transformer is developed, composed of a thin magnetostrictive ferrite bar cemented at one end to a thin piezoceramic bar with side plated electrodes. Preliminary measurements of the two component bars serve to verify the preceding theory qualitatively, and illustrate typical numerical values for the respective electromechanical material coefficients. The composite transformer response is measured to indicate the behavior of a mechanically symmetrical four terminal device, as well as the effects of a marked difference in internal dissipation for the component bars.

To verify the antireciprocal nature of transmission for composite piezoelectric-magnetostrictive bars, additional bilateral circuit elements have been added to the experimental transformer to obtain one-way transmission at the fundamental resonance mode of vibration. The experimental results show a transmission directivity with greater than 65 decibels discrimination.

Microfilm $4.25; Xerox $14.40. 332 pages.

PROBABILITY OF SPARKOVER OF SMALL GAPS

(L. C. Card No. Mic 58-3204)

Prachuab Vanapruk, Ph.D.
Purdue University, 1958

Major Professor: C. S. Sprague

Sparkover of a gap when subjected to an impulse voltage is a random event. A study of mechanisms leading to gaseous discharge suggests that the probability of sparkover of a small gap in uniform electric field depends on the initial electrons to start the discharge process, the gap surface area, the over voltage of the gap, and the time duration of the over voltage.

In this research, theoretical deductions resulted in a general form of the equation for the probability of sparkover,

$$P = 1 - \epsilon^{-Kn_oAF(S)t}$$

where K is an arbitrary constant, n_o the rate of production of electrons in the gap, A the gap area, F(S) a function of the ratio of over voltage to threshold sparking potential, and t the time during which the voltage exceeds the threshold value.

Experiments had been performed, in air at atmospheric pressure and temperature, to prove the validity of this equation, and to empirically determine the form of F(S).

Investigation of the effect of gap area on the probability of sparkover was done indirectly by simultaneously subjecting an increasing number of small gaps to a test wave. Logical conclusions of the experimental result were drawn to support the mathematical consideration used in developing the equation of probability of sparkover.

To investigate the effect of time duration of over voltage, and also to determine the form of F(S), a small brass gap of plane parallel surfaces was used. The gap was subjected to a rectangular voltage wave obtained by discharging a cable through a terminal resistance. The cable length provided accurate measurement of the time duration of the voltage wave. A compensation for attenuation of the traveling wave due to resistance and skin effect was simply achieved by connecting an appropriate value of capacitance in series with the terminal resistance.

F(S) was found to be of the form,

$$F(S) = S^c$$

where c is a constant empirically determined by the experiments. This gives the general form of the probability of sparkover as,

$$P = 1 - \epsilon^{-Kn_oAS^ct}$$

For the particular gap and conditions described in this thesis, average values of Kn_oA and c were found to be 0.853×10^5 and 3.83 respectively.

Microfilm $2.00; Xerox $4.40. 83 pages.

ANALYSIS AND DESIGN OF RELAY TYPE SERVOMECHANISMS WITH DEAD TIME AND SAMPLING

(L. C. Card No. Mic 58-3205)

Lynn Edward Weaver, Ph.D.
Purdue University, 1958

Major Professor: E. M. Sabbagh

This investigation is a phase plane study of relay type servomechanisms with sampling and dead time. Through the use of the phase plane, a new approach to relay type servomechanisms with sampling is brought out. In the phase plane the effect of sampling upon the steady state behavior of the output variable is analyzed and the limit band and varying limit cycle concept introduced. By means of the phase plane and limit band and varying limit cycle concept, an analysis and design procedure is established. To check the theory derived, the results of an analog computer study are presented and a comparison made between theoretical and computer results.

Microfilm $2.00; Xerox $5.40. 109 pages.

ENGINEERING, MECHANICAL

ADHESION BETWEEN RAILS AND WHEELS OF RAILWAY MOTIVE POWER

(L. C. Card No. Mic 58-5396)

George Merrifield Cabble, Jr., Ph.D.
University of Illinois, 1958

For more than 150 years, railroad men have been concerned about adhesion between wheel and rail. Adhesion seems to decrease as speed increases, although some argue that there is no theoretical basis for this because there is no relative velocity between a true rolling wheel and the rail; thus static friction prevails. It is, therefore, claimed that true adhesion does not vary, but adhesion variers such as wheel unbalance, truck dynamics, rail joints, and others cause momentary unloading of one or more wheels. Since adhesion is the accelerating force at the rail divided by the normal weight at that point, the true value of adhesion might not change, but a reduction in wheel load would require an increase in true adhesion to maintain the same accelerating or decelerating force. An additional cause for reduced adhesion is slippery rail. Recently, the use of a rail conditioner, both in this country and abroad, has improved the adhesion available on previously slippery rail.

This investigation was conducted on a one-tenth scale wheel of approximately four inches diameter, made of wheel steel, and a disk of approximately eight inches diameter, made of rail steel. The tests were conducted with wheel and rail contact surfaces ground smooth, polished and cleaned with carbon tetrachloride.

It was discovered that creep takes place between wheel and rail as long as there is an accelerating or decelerating force. The percentage creep increased slightly as the adhesion demand increased until approximately 50% adhesion was required. At this point, slip was noticeable, and the percentage creep, or slip, increased rapidly as the adhesion demand increased slightly. The final result as the adhesion demand increased was slide.

It was further concluded that true adhesion does decrease with increased velocity, because some sliding friction is present at the point of contact, and sliding friction decreases with increased velocity. Since the percentage creep is the same for a given adhesion demand regardless of velocity, the sliding velocity is higher for higher wheel velocities.

It was also shown that contact surfaces cleaned with carbon tetrachloride could sustain three times as much adhesion demand as surfaces wiped with a clean rag and five to six times as much adhesion demand as surfaces wet with water or wiped with either skin oil or lubricating oil. Microfilm $2.00; Xerox $5.20. 102 pages.

COMBINED FORCED AND FREE CONVECTION IN A VERTICAL TUBE

(L. C. Card No. Mic 58-3160)

Theodore Morgan Hallman, Ph.D.
Purdue University, 1958

Major Professor: Richard J. Grosh

An analytical and experimental study is made of laminar heat transfer in a vertical circular tube under the conditions of combined forced and free convection. This study includes an analysis of the effect of uniform volume heat sources in the fluid, such as would occur in a fluid-fuel nuclear reactor.

An analysis is made which predicts fully developed velocity profiles, temperature profiles, mixed-mean-to-wall temperature differences, Nusselt numbers and pressure drops. The boundary conditions considered are uniform wall heat flux and uniform wall temperature, and the mean flow direction may be either up or down.

The parameter which is significant as a measure of the influence of the free convection on the forced convection is the Rayleigh number, defined as

$$N_{Ra} \equiv \frac{\rho^2 \beta g^2 c_p A D^4}{16 \mu k}$$

Here, A is the axial temperature gradient, which is assumed to be uniform everywhere in the fluid, D is the tube diameter, and β is the thermal coefficient of volume expansivity. The Rayleigh number may be positive, if the fluid is hotter above, negative, if the fluid is hotter below, or zero, if the fluid is at a uniform temperature everywhere or if β is zero.

The result of analysis for positive Rayleigh numbers and no internal heat generation is a single relation between Nusselt number and Rayleigh number. A graph of the relation is presented, and for Rayleigh numbers in the range $100 \leq N_{Ra} \leq 10{,}000$, the analysis is well approximated by the equation

$$N_{Nu} = 1.40\ N_{Ra}^{0.28}$$

For smaller Rayleigh numbers, the analysis approaches a Nusselt number of 48/11 (= 4.36) as the Rayleigh number approaches zero. This is the well-known value of Nusselt number for fully developed pure forced convection with uniform wall heat flux.

An experiment was designed and built to experimentally verify the heat transfer in a vertical tube with uniform wall heat flux and no internal heat generation. The working fluid used was distilled water at a pressure of 2 atmospheres. Provision was made for obtaining data in both upflow with heating (positive Rayleigh number) and downflow with heating (negative Rayleigh number).

Positive Rayleigh numbers ranged from 27 to 2700 and Reynolds numbers were varied from 27 to 3300. The experimental fully-developed Nusselt numbers checked very well with the analysis. A transition to a fluctuating flow was observed under certain conditions. A correlation found for the transition data indicates that fluctuations will occur for values of N_{RaD} above those given by the equation

$$N_{RaD} \equiv \frac{\rho^2 \beta g^2 c_p D^3 (t_w - t_m)}{\mu k} = 9470 \left(\frac{N_{Re} \cdot N_{Pr}}{2x/D} \right)^{1.83}$$

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Here $(t_w - t_m)$ is the local wall-to-mixed-mean temperature difference and x is the distance from the beginning of heating. This relation is valid for the range $1 < N_{Re}N_{Pr}/2x/D < 20$.

Negative Rayleigh numbers ranged from -50 to -115. The Nusselt numbers fell about 10 percent above the predicted curve. Asymmetric wall temperature distributions were found for negative Rayleigh numbers, which became more severe as the Rayleigh numbers were increased. Periodic variations of wall temperature were observed at the largest negative Rayleigh numbers.

The thermal entrance region analysis for pure forced convection heat transfer of Siegel, Sparrow, and Hallman[1] was experimentally verified. Thermal entrance lengths for positive Rayleigh numbers were found to be shorter than for pure forced convection, whereas those for negative Rayleigh number were found to be longer than those for pure forced convection.

Microfilm $3.00; Xerox $10.20. 229 pages.

1. Siegel, R., E. M. Sparrow, and T. M. Hallman, "Steady Laminar Heat Transfer in a Circular Tube with Prescribed Wall Heat Flux," Applied Scientific Research, Section A, 7, 1958.

EXPERIMENTAL AND THEORETICAL STUDY OF THE APPLICATION OF FILM-COOLING TO A CYLINDRICAL ROCKET THRUST CHAMBER

(L. C. Card No. Mic 58-3194)

John Paul Sellers, Jr., Ph.D.
Purdue University, 1958

Major Professor: Maurice J. Zucrow

When the heat transfer to the walls of a rocket motor is so intense that regenerative cooling becomes inadequate, film-cooling may be used as a means for protecting them. This thesis presents data obtained from experiments wherein a test section, a portion of the thrust cylinder of a 500-lb thrust rocket motor, was film-cooled with inert and also reactive liquid film coolants. The reactive coolants included the propellants* of the rocket motor, WFNA and JP-4. The rocket motor was operated at 500 psia combustion pressure. The thesis also contains an approximate theory of film-cooling which is based on elementary boundary layer theory. A simplified model was assumed in order that non-laborious engineering calculations may be made. The theory assumes that the hot gas is in turbulent flow, the internal coolant does not react chemically with the hot gas, and that the pressure gradient in the direction of flow for the hot gas is small enough to be neglected.

The theoretical relationships which are derived between the film-coolant flow rate and the physical properties of the film coolant and of the hot gas are of interest from a practical standpoint. When the relationships are known, then the desirability of internal cooling in a proposed application may be intelligently considered. The theoretical equations also show the effect of gas temperature on the evaporation rate of the film coolant, which is important in advanced rocket engineering since the performance of a rocket motor depends to a large extent upon the square root of the gas temperature.

The parameters derived from the theoretical analysis that served as the variables in the experimental study are based on the physical properties of the internal coolant and the length of the coolant film. When the parameters based on the physical properties of the coolant were varied experimentally over a wide range, the theory predicted closely the observed effect on the evaporation rate of the liquid film. The agreement did not depend upon whether the coolant was reactive or inert.

The lack of numerical agreement between the results obtained from the theory and those obtained experimentally are believed to be due to the following causes: (1) the differences between the simple model upon which the theory is based and the complex phenomena occurring in the thrust cylinder of a rocket motor, and (2) certain losses of internal coolant not taken into account in the theory. It is suggested that the theory be modified to take into account the losses in internal cooling by introducing some form of effectiveness parameter; it appears that those losses cannot be eliminated entirely in a practical case. The losses are believed to be due to (1) non-uniform coverage of the wall by the internal coolant (2) hot streaks in the gas stream, and (3) a rough surface on the film. To help understand the cause of the losses, a study of the gas-liquid interface by direct observation was made possible by the use of a procedure developed for photographing the film of liquid coolant flowing along the wall of the rocket motor.

Microfilm $2.15; Xerox $7.60. 164 pages.

*WFNA = White fuming nitric acid
JP-4 = Jet engine fuel

NATURAL-CONVECTION HEAT TRANSFER WITH WATER AT HIGH GRASHOF NUMBERS

(L. C. Card No. Mic 58-5515)

Paul John Waibler, Ph.D.
University of Illinois, 1958

While satisfactory analytical solutions of the equations of motion and energy for a fluid in laminar-flow natural-convection do exist, such is not the case when the flow must be considered as turbulent. The more approximate methods of solution for the film coefficients of heat transfer with turbulent flow have resulted in considerable difference in the values predicted by various writers and poor agreement with the few experimental values that now exist.

In this paper, an analysis is presented which is based on the assumptions that the velocity and temperature distributions for natural convection are similar to those of forced convection for the region close to the heated surface, that the shear stress at the wall can be expressed by the Blasius law, and that the Reynolds analogy is applicable. A reference velocity is established which is analogous to the reference velocity of forced convection, and which shows that the Grashof number is a special case of the Reynolds number, applicable to natural convection. The application of the von Karman momentum equation of the boundary layer results in an equation expressing the local Nusselt number as a function of the Grashof and Prandtl numbers. It is shown that when the Nusselt number is expressed as $Nu_x = C\,(Gr\ Pr)^n$, the values of the coefficient C and the exponent n are both dependent on the

particular power law used to formulate the velocity distribution and the particular formulation of the Blasius law for the wall shear.

An experimental program was carried out in which the local film coefficients of heat transfer and the velocity and temperature distributions were determined. The apparatus consisted of a steam-heated brass plate 8 feet high which formed one side of a vertical column which was approximately one foot square. An unheated parallel plate divided the column into two parts, in one of which the heated water, flowing upward was removed at the top. Cold water was added in the other leg at the same rate. The space between hot and cold plates could be varied to a maximum of 2 1/2 inches. Velocity measurements were made by measuring the difference in levels of the free surfaces formed by the static and total pressure taps with an optical device which multiplied the difference by 156. Temperatures were measured by small copper-constantan thermocouples. The local heat transfer rates were determined by collecting the condensate from small traps attached to the steam side of the heated plate.

The heat transfer rates were found to be only slightly affected by the spacing between the heated and cold plates, and to decrease from the bottom to the top of the heated plate. The data for the largest spacing (2 1/2 inches) was well correlated by the equation, $Nu_x = 0.795\ (Gr.\ Pr.)^{0.285}$ The largest Grashof-Prandtl number product was approximately 10^{14}. The experimental velocity distributions were better approximated by $U/U_{max} = C(y/\delta)^{Y^3}$ for the region close to the heated plate, than by the usual 1/7 power law of forced convection. Velocities as low as 0.2 feet per second were measured.

Microfilm $2.00; Xerox $5.20. 103 pages.

ENGINEERING MECHANICS

PERMANENT PERIODIC SURFACE DEFORMATIONS DUE TO A TRAVELLING JET

(L. C. Card No. Mic 58-3590)

George Raymond Abrahamson, Ph.D.
Stanford University, 1958

A flat-nosed steel bullet which is fired obliquely into a thin, plane, sheet metal target at conventional rifle velocity may develop permanent, wave-like, periodic deformations on its front surface.[1] For example, an 0.5-inch diameter steel bullet striking an 0.010-inch thick lead target at about 3000 ft/sec and at an angle of incidence of 45^0 will acquire periodic deformations on its front surface of approximately 0.03-inch wavelength and 0.02-inch amplitude. Similar, but not identical, periodic deformations may be produced on the surface of a metal slab when a thin metal sheet is driven at high velocity obliquely against the surface of the slab by an explosive charge. In both cases, the wavelength diminishes with decreasing angle of incidence and below a certain critical angle of incidence, which depends upon the velocity of impact and the particular metals, no waves appear. For a steel bullet which strikes a lead target at 3000 ft/sec the critical angle of incidence is about 5^0.

Due to the high velocity of impact, the state of stress in the metals in the region of impact consists of a large average pressure and relatively small shearing stresses, similar to the stress field in a liquid of low viscosity. Hence, in the region of impact, the metals may be regarded as behaving essentially as liquids. Thus, when observed in a reference frame which moves across the surface of the bullet or slab with the instantaneous point of impact, the thin metal sheet appears as a jet which impinges upon a moving base.

Allen, Mapes, and Wilson in their original paper[1] indicated, on the basis of a hydrodynamic theory in which the impinging metals are considered as inviscid liquids, that periodic surface deformations occur at supersonic jet and base velocities when the angle of incidence is greater than a certain critical value. They also suggested that this critical angle corresponds to the critical turning angle associated with flow through an oblique shock wave.

In the present work it is shown that periodic surface deformations occur in metals at subsonic as well as at supersonic jet and base velocities. From this fact it is reasonable to expect that similar periodic surface deformations might be produced at relatively low velocities with suitable materials. Experimental results are presented which show that periodic deformations are indeed produced on the surface of a base of heavy grease when it is passed under a jet of air or water at a suitable velocity. Photographs showing the development of waves in a base of silicone putty as it passes under a jet of water are also presented. The velocities in the latter experiment were such that the period of wave formation was about 12 minutes. The wavelength was about 0.3 inch and the amplitude about 0.2 inch. A plausible mechanism of wave formation is described based on the photographs of the development of the waves in silicone putty. This mechanism depends upon a basic instability in the jet-base system which is due to the liquid nature of the impinging jet. It is indicated that this mechanism is also reasonable for the waves produced in metals.

A fairly complete analysis is given of a theoretical model having a viscous base. The behavior of this model in many respects reproduces that observed in the experiments. Microfilm $2.00; Xerox $4.00. 72 pages.

1. Allen, W. A., J. M. Mapes, W. G. Wilson, "An Effect Produced by Oblique Impact of a Cylinder on a Thin Target," J. Appl. Phys. 25, No. 5, 675-676 (1954).

MINIMUM RESTRICTIONS ON ENERGY METHOD IN ELASTICITY

(L. C. Card No. Mic 58-5353)

Afzal Muhammad Kazi, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Gerald Pickett

The displacements are written as polynomial expressions which satisfy boundary conditions with regard to these displacements. Elastic strain energy V is computed in the usual way. The coefficients of the various terms in the expressions for displacements are then determined by

minimizing the total energy U [= V - W] with regard to these coefficients, where W is the potential energy lost by the loads. Microfilm $2.00; Xerox $3.60. 65 pages.

ENGINEERING, METALLURGY

RECOVERY AND SUBGRAIN GROWTH IN COLD-ROLLED SINGLE CRYSTALS OF ALUMINUM

(L. C. Card No. Mic 58-5481)

Bernard Gordon Ricketts, Ph.D.
University of Illinois, 1958

High purity aluminum crystals, grown to a prescribed (110) [1$\bar{1}$2] orientation by an improved soft-mold technique and deformed by cold rolling to 80% reduction of area, were used to study softening and subgrain growth which preceded recrystallization during annealing. Within a spread of a few degrees, the crystals retained their original orientation after deformation and could be annealed for comparatively long periods of time at high temperatures before the onset of recrystallization.

The rolled metal was electrolytically thinned, then heat treated for various lengths of time at temperatures between 200° and 400° C. Microhardness measurements were made both before and after heat treatment. The subgrain structure was investigated by means of electron transmission microscopy. Specimen preparation consisted of electrolytic forming to the shape of a disc, 1/8 inch in diameter by 0.010 inch thick, and electrolytic thinning of the disc to the point of perforation at its center.

Within the range of annealing temperatures used, the hardness decreased approximately linearly with the logarithm of time, the slope of the straight line of harness vs. log time increasing with higher annealing temperature. Complete softening could not be obtained without recrystallization. The maximum obtainable softening without recrystallization, occurring at the highest annealing temperature used, amounted to 45%. A single activation energy could not be applied to the softening data. The apparent activation energy was found to increase with progressive softening.

A heavily deformed aluminum crystal in the unannealed condition exhibits a definite subgrain structure of about 1.2 micron average diameter, characterized by an irregular boundary structure and segments of dislocations, and of dislocation walls within the subgrains. During annealing a clearing of the subgrains of fragmentary dislocation walls was observed, along with straightening of the boundaries. The process was not completed before the beginning of recrystallization. The subgrain size was stable at low temperatures but increased with higher annealing temperatures and longer annealing times, reaching a maximum average diameter of about 2.7 microns before the onset of recrystallization. The progress of subgrain growth and of softening were approximately parallel.

Microfilm $2.00; Xerox $5.40. 108 pages.

ENGINEERING, SANITARY AND MUNICIPAL

CONTROLLED ATMOSPHERES FOR AIR POLLUTION STUDIES

(L. C. Card No. Mic 58-3499)

Roy O. McCaldin, Ph.D.
The University of Florida, 1958

The study was stimulated by problems encountered in air pollution sampling and by questions regarding the physical limitations of sampling devices. The research deals with the design and operation of a large chamber that can contain polluted atmospheres for test purposes. These atmospheres in turn can be used in calibrating and evaluating air sampling instruments.

The chamber used in this study was of wood frame construction, and the interior was of masonite which was coated with polyvinyl chloride, a chemically resistant plastic. The chamber was built in the shape of a cube with six-foot sides. The volume is 216 cubic feet or 6.12 cubic meters. The chamber is equipped with a number of sampling ports, a fan blade for mixing air and gas, and has provision for both dynamic and static operating conditions. When tested for leakage, it was found that under normal operating conditions loss of air from the chamber is less than 1 per cent of the chamber volume per day.

A hypodermic syringe with needle was used to inject measured quantities of study gas into the chamber. It was found that the hypodermic syringe feed method was reasonably accurate for volumetric measurements, but in order to translate the volume of gas into weight units, care had to be taken to control gas temperature. It was also necessary to standardize each hypodermic syringe containing the more reactive gases, by injecting a measured portion of the gas into a flask for analysis.

The rate with which gas is mixed in the chamber was determined by injecting a gas, starting the mixing fan, and taking successive samples at different ports. The chamber content was considered mixed when the samples taken from different ports showed the same results. For the particular combination of fan blade and speed used it takes 10 minutes to achieve complete mixing.

The adsorption of gas on the chamber walls was studied for sulfur dioxide, hydrogen sulfide, and hydrogen fluoride. The test procedure was to determine the difference between the theoretical gas concentration based on volume of chamber and gas added, and the actual gas concentration determined from analysis of samples. It was found that at the gas concentrations used, the amount of adsorption was directly related to the partial pressure of the study gas. It was also directly related to the surface area in the chamber. Approximately 33 per cent of the hydrogen fluoride admitted to the chamber was adsorbed on its walls. Approximately 10 per cent of the sulfur dioxide and only 6 per cent of the hydrogen sulfide were adsorbed.

The rate at which a study gas concentration is diminished was also considered. The amount of gas dilution occurring as a result of sample withdrawal and replacement with fresh air was calculated analytically. The reduction in gas concentration that occurred with time of storage in the chamber was determined experimentally. It was found that sulfur dioxide concentrations diminish about 7 per cent for each day of storate. Hydrogen sulfide diminishes about

26 per cent per day, and hydrogen fluoride concentrations diminish about 12 per cent per hour.

With a chamber to hold the gas, a method to admit measured quantities, an estimate of the effective concentration, and an estimate of the loss rate for that concentration, it is possible to achieve a desired concentration for a given gas for a predetermined length of time. This reservoir of known gas concentrations can be used for comparative studies of air sampling instruments.

Microfilm $2.15; Xerox $7.60. 162 pages.

FACTORS INFLUENCING FROTHING IN SEWAGE TREATMENT

(L. C. Card No. Mic 58-5369)

Lawrence Benjamin Polkowski, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Gerald A. Rohlich

In recent years, the occurrence of frothing in the activated sludge sewage treatment plants has presented a problem in the form of hazard and nuisance conditions adjacent to the aeration tanks. Observation of the occurrence of frothing associated with certain operating conditions have been reported in the literature, but quantitative foam measurements related to the various factors believed to be associated with frothing have not been studied in mixed liquors. Thus, more information regarding the influence of various factors were evaluated in order to obtain information that could be used as a basis on which to develop measures for the control of frothing in sewage treatment.

Two froth measurement parameters were devised, based on studies of foam measurement developed in related fields. The foam measurements used, persistency and the average lifetime of the bubble in the foam (Σ), were developed for use with mixed liquors containing suspended solids. The static foam measurement, persistency, was made in a 500 ml mixing cylinder with 250 ml of mixed liquor. The persistency time interval was the measured time interval for the foam, formed by shaking, to clear at the liquid surface. The Σ measurements were made with a specially designed foam meter for mixed liquor samples. The values of Σ were calculated according to the formula:

$$\Sigma = \frac{V}{\frac{dVa}{dt}}$$

where V equals the maximum volume of foam formed for a given rate of aeration (dVa/dt).

Frothing studies were made of mixed liquor samples obtained from municipal sewage treatment plants and the mixed liquors were aerated in batch laboratory aeration units under controlled aeration and mixing rates. Thus, the various factors and conditions were correlated to the froth parameters at the different aeration intervals. Some of the factors measured were of the mixed liquor and others of the mixed liquor filtrates. The following analyses were made of the membrane filtrates: alkylbenzene sulfonate, organic nitrogen, and ammonia nitrogen. Analyses made of the mixed liquors were electrode potential (E_h), temperature, pH, and suspended solids, and 5-day biochemical oxygen demand.

Using the froth parameters as the dependent variables, the measured factors were correlated by simple and multiple correlation techniques. The results indicated that 60 to 70% of the variation in the froth parameters were accounted for by the measured factors and that the alkylbenzene sulfonate factor was the most important single factor accounting for the variation. The froth measurements used were generally in agreement, although different in magnitude, and were related to frothing conditions at the sewage treatment plants. The effect of suspended solids on frothing has been shown to be negatively correlated to persistency for samples of mixed liquor from the same sewage treatment plant. Frothing was positively correlated with pH and temperature, and no significance could be attached to the organic nitrogen and BOD factors.

In order to minimize frothing in the aeration units of an activated sludge sewage treatment plant, the free alkylbenzene sulfonate, i.e. that portion which is in solution as opposed to the ABS bound by the biological floc, should be maintained at a low concentration and the suspended solids should be maintained as high as operating conditions will permit. Microfilm $3.05; Xerox $10.40. 235 pages.

CHARACTERISTICS OF CORN STARCH AND STARCH DERIVATIVES AS AFFECTED BY FREEZING, STORAGE, AND THAWING

(L. C. Card No. Mic 58-5385)

James Joseph Albrecht, Ph.D.
University of Illinois, 1958

An investigation of the characteristics of various starches and starch derivatives after freezing, storage, and thawing was carried out to determine the effect of various processing variables on the freeze-thaw stability of starch slurries and white sauces. Overall objectives of the investigation were (1) to determine experimentally the effect of such physical variables as rate of freezing, storage time and temperature, shearing of granule systems, and heat treatment prior to freezing; (2) to utilize the information obtained above in an attempt to produce a typical white sauce system which would be stable to freezing temperatures, storage at these temperatures, and subsequent thawing at room temperature.

It was shown that there was a noticeable decrease in the enzyme susceptibility of pregelatinized slurries of regular corn starch when such slurries were exposed to sub-freezing

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

temperatures. These same samples, which were smooth gels prior to freezing, exhibited sponge formation after freezing and thawing. It was shown that there was a direct relationship between enzyme susceptibility and degree of retrogradation; the greater the amount of retrogradation, the lower the susceptibility to attack by B-amylase.

As long as slurries of regular corn starch were not heated above the critical gelatinization point of 163°F., these slurries remained essentially unchanged after freezing and thawing; however, when heated to temperatures above 163°F., severe retrogradation took place, resulting in typical starch sponge formation. After freezing and thawing, only a slight decrease was observed in the enzyme susceptibility of slurries of pregelatinized, cross-linked waxy maize starch, as compared to unfrozen samples. Various preheating treatments had no significant effect on the stability of frozen slurries of this starch, or of starch phosphate.

Retrogradation was slightly more rapid in starch slurries stored at 0°F. than samples stored at -40°, +10°, or -20°F. There was no difference in the gross physical appearance of any of these samples. It was also shown that most retrogradation of starch slurries takes place within 24 hours after the samples have been placed in frozen storage. Subsequent retrogradation takes place at a much slower rate during storage.

Freezing starch slurries instantaneously by direct immersion into liquid nitrogen (-200°F.) eliminated sponge formation from samples of pregelatinized corn starch, and the curdled appearance from waxy maize slurries. Very little retrogradation took place when these samples were stored at 0°F. for one week.

Moderate shearing of starch slurries prior to freezing had essentially no effect on the stability of such systems. Severe shearing techniques damaged the starch granules, as shown with photomicrographs, but this damage had no apparent effect on freeze-thaw stability.

Using an end-over-end type retort, it was shown that the higher the temperature of preheating, the lower the rate of starch retrogradation during storage at 0°F. Starch phosphate samples were not stable to preheating temperatures above 225°F.

Standard white sauces were prepared with various starch thickening agents, and a control sample was prepared with all-purpose flour as the thickener. It was found that enzyme susceptibility was not a suitable criterion for retrogradation in white sauces. A six-member taste panel graded the sauces for organoleptic properties, and the data were subjected to a statistical analysis of variance. Treatments of the white sauces included severe homogenization and freezing in liquid nitrogen.

Severe homogenization resulted in improved freeze-thaw stability of white sauces, but freezing in liquid nitrogen had no significantly beneficial effects. This was in direct antithesis to results obtained with simple starch-water slurries, and emphasized the important differences between these two systems.

Based on the results of experiments with both white sauces and starch-water slurries, thickening agents were rated in decreasing order of freeze-thaw stability as follows: starch phosphate; ungelatinized regular corn starch; pregelatinized, cross-linked waxy maize starch; flour; and pregelatinized regular corn starch.

Emphasis was placed on the effects of pregelatinization of starches prior to freezing, and on the radical difference between standard white sauces and simple starch-water slurries. Microfilm $2.25; Xerox $7.80. 169 pages.

DEGRADATION OF CHLOROPHYLL TO PHEOPHYTIN DURING STERILIZATION OF CANNED GREEN PEAS BY HEAT

(L. C. Card No. Mic 58-5341)

Harvey Joseph Gold, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Kenneth G. Weckel

Color is an important factor in the quality of food products. Canned green vegetables undergo a marked change in color, from bright green to olive-brown, when they are sterilized by heat. The color of the sterilized product is considered to be less attractive than that of the fresh vegetable. The reaction responsible for the color change is the substitution of the magnesium of the chlorophyll molecule by hydrogen, supplied from plant acids, forming the compound, pheophytin. This study was undertaken to define the kinetics of the reaction under the conditions necessary for the sterilization of green peas.

The study was conducted over a period of two years, 1956 and 1957. During the first year, peas were heat processed for various lengths of time under conditions similar to those employed commercially. The amount of conversion of chlorophyll to pheophytin during heat processing was measured spectrophotometrically. During the second year, peas were heated in a specially constructed apparatus, by direct contact with steam. They were cooled by direct contact with cooling water. This procedure minimized the heating and cooling lags inherent in commercial retort operation and enabled close control of the time intervals used in heat processing. During the first year, the heat processing temperatures used were 212, 240 and 260 degrees F. (100, 115.6 and 126.7 degrees C.). The heat processing temperatures used during the second year were 240, 260 and 280 degrees F. (115.6, 126.7 and 137.8 degrees C.).

During the second year, the effect of pH on the reaction was studied by the incorporation of various amounts of acid or base into purees prepared from peas. Tubes of puree were heat processed in the specially constructed apparatus mentioned.

It was found that the degradation of chlorophyll to pheophytin in peas, under the conditions described, followed pseudo-first order kinetics. In purees, it was found that the pseudo-first order rate constants were related linearly to the initial titrateable acidity of the puree. This slope of this line is a linear function of temperature.

The first order rate constants for the reaction in blanched peas were found to be greater than in unblanched peas.

A close linear correlation was found to exist between the hue of the color of heat processed peas, as measured by a Hunter Color and Color Difference Meter, and the extent of chlorophyll degradation.

A rapid method using an inexpensive colorimeter has been described for estimating the percent conversion of chlorophyll to pheophytin. This method may be applicable to routine quality control operations in a commercial canning plant. Microfilm $2.00; Xerox $4.60. 88 pages.

LAND, WATER, AND AGRICULTURE IN VILLAGE COMMUNITIES OF THE UPPER DAMODAR VALLEY, INDIA

(L. C. Card No. Mic 58-5391)

George Franklin Beatty, Ph.D.
University of Illinois, 1958

The richness and abundance of land and water resources, and the productiveness of agriculture in the village communities of the Upper Damodar Valley, India, have greatly deteriorated through the centuries. This situation is the result of many factors. Natural factors such as steep slopes, heavy rainfall, and strong leaching of the soil are causing tremendous soil loss and a lowering fertility of the soil, as well as a waste of water. At the same time, man-induced factors such as over-grazing, the excess removal of wood and other products from the woodlands, and poor farming practices of raising thinly-spaced crops on the uplands, plowing up-and-down slope, and poor pasture management have greatly accelerated soil loss, the rate of decrease in soil fertility, and the waste of water. All of these factors, along with the dry and wet season nature of the climate of the region, which, with the present poor water storage facilities, contribute to low agricultural productivity. Many of these factors, accentuated by the smallness of farms and their scattered fields, and the use of simple tools and laborious farming techniques are also the cause of many difficulties in farming.

A detailed analysis of villages shows that the following important specific problems of land, water, and agriculture exist in the region: 1) severe soil erosion, which not only has reduced the extent of farmland, in some instances by ten per cent, but threatens almost complete destruction of the land, 2) nutrient deficient soils, which are a major cause of poor crop yields, 3) severely depleted woodlands and associated vegetation, which yield only limited quantities of products, products which are of very low quality, 4) unavailability of ground water, which has reduced the usefulness of ground water as a source of water supply, 5) extreme seasonal fluctuation in the ground water level and in stream flow, which restricts the usefulness of natural water supply to the rainy season only, 6) the limited water holding capacity of tanks, which limits their effectiveness in irrigation, 7) the severe limitations on the extension of farmland by steep slopes and soil erosion, which keeps farms small and uneconomic, 8) scattered small fields on individual farms, which make the application of improved farming techniques and equipment difficult or even impossible, 9) poor physical condition of the livestock, which lessens their working efficiency and contributes to more laborious farming, 10) dry season agricultural inactivity, which contributes to low annual crop production, 11) poor farm roads, which make the marketing of farm products difficult, and 12) limited quantities and the poor quality of home manufactured products, which require a disproportionate amount of the farmers' time in respect to the income received from their sale.

A number of government resource and agricultural development programs, as part of the First Five Year Plan of India, are attempting to solve or at least lessen the severity of these problems of land, water, and agriculture in the villages of the region. These programs are introducing corrective measures in agriculture and other resource use within the prevailing pattern of land use. The corrective measures being introduced include check dams and runoff ridges, which halt soil loss directly, reforesting cut-over areas, improvement of crop varieties, use of chemical fertilizers, extension of irrigation by modern canal systems and large reservoirs, consolidation of farmland, and contour plowing, upland terracing, and other conservation farming practices. Moreover, improved village resources and agriculture contribute towards improved home manufacturing by providing more abundant and better quality raw materials. Insufficient time has elapsed for a practical evaluation of the Valley programs, but a successful beginning appears to have been made.

Microfilm $3.35; Xerox $11.40. 259 pages.

GEOGRAPHIC ASPECTS OF HOSPITAL PLANNING

(L. C. Card No. Mic 58-3501)

William Mark McKinney, Ph.D.
The University of Florida, 1958

The purpose of this dissertation is to investigate the relationship that exists between geographic factors and the regional planning of hospitals. Regional hospital planning deals with the problems of determining the size and location of hospitals and the boundaries of the areas which they are to serve.

A great deal of the information used in this dissertation was gathered during field visits to hospitals and communities in the state of Georgia. This was supplemented by discussions of hospital planning problems with persons engaged in the planning, medical and public health fields, and by a study of published and unpublished material in the field of hospital planning.

The regional hospital planner must consider such factors of the geographic environment as physical features, existing political divisions of territory, population density, special problem areas, and the composition of the population. He must avoid the effects of barriers to the movement of patients and medical services, including both natural and man-made barriers. He must also make sure that space will be available to patients upon their arrival at the hospital, and that facilities will be available to all groups of the population.

Although existing agencies for regional hospital planning have made occasional mistakes, the work of these agencies has been an overall success. Hospital facilities are now available to both areas and to groups of the population which had no facilities in the past. The effectiveness

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

of hospital planning agencies would be improved if they were to employ more geographers and social scientists, coordinate their activities with those of other planning agencies, and adopt a broader, more comprehensive approach to their subject.

Microfilm $2.45; Xerox $8.40. 185 pages.

THE ISLE OF PINES, CUBA: A GEOGRAPHIC INTERPRETATION

(L. C. Card No. Mic 58-3506)

Morton D. Winsberg, Ph.D.
The University of Florida, 1958

The Isle of Pines, Cuba (La Isla de Pinos) is a tropical island 1,181 square miles in area lying approximately forty miles off the southwestern coast of Cuba. A swamp, which bisects the island in an east-west direction, divides the island into two distinct physical regions which differ in geologic structure, physiography, and vegetation. North of the swamp lies a plain underlain by schistose rock and broken in several places by residual marble and schist ranges which rise to a maximum relief of one thousand feet above sea level. South of the swamp is a low limestone plain developed in a more recent geological period. Soils are low in fertility on the northern plain and almost absent on the southern. The northern plain has a savanna type vegetation, the southern a dense hardwood forest.

The island has been settled by Europeans for over 450 years. In this long period, despite the fact that it is located near Cuba's highest concentration of people, it has grown slowly in population. By 1785 less than 150 people resided on the island, and in 1899 this number had risen to only 3,199. Since 1899, growth has continued to be slow, and at the present time there are no more than 11,000 inhabitants, 2,000 of whom are prisoners interned in the National Penitentiary, located on the island.

The island's relatively infertile soils and isolation from Cuba have continually conspired to deter economic development. Until the twentieth century there was almost a complete lack of interest on the part of the Colonial Government or of the island's landowners to initiate any economic activity. During this period pirates and smugglers often used the southern coast as a base for their operations.

At the conclusion of the Spanish-American War, due to two ambiguous clauses in the Treaty of Paris, a number of Americans arrived on the island under the misapprehension that the island was American. Between 1903 and 1925 there were years when the American community rose to one thousand, and at times over ten thousand Americans actually owned property there. In 1908 it was estimated that nine-tenths of the island was owned by Americans. During this period almost one thousand people from the Cayman Islands, Japan, and other foreign countries immigrated to the island.

The agricultural economy of the island has always been basically one that only satisfied local demands. However, Americans initiated grapefruit and winter vegetable production for export. Shipments of produce were mainly to the United States, but growers also traded with Cuba. Commercial agriculture prospered in the early twentieth century, but in recent years increased competition from other growing areas caused by the island's high growing and marketing costs have caused a decline in production. Although cucumbers and grapefruit continue to be the two largest contributors to the island's economy, several large growers have turned to commercial production in an attempt to diversify.

The Isle of Pines has small fishing, mining, and tourist industries. All three have been poorly developed because of the island's isolation and poor marketing position. The Cuban Government, in an attempt to alleviate depressed economic conditions on the island has inaugurated a number of programs designed to lessen the island's marketing disadvantage. At the present time it is too early to state whether these programs will be successful.

Microfilm $2.85; Xerox $9.80. 220 pages.

GEOLOGY

GEOLOGY AND PETROLOGY OF THE CALAIS AND ROBBINSTON QUADRANGLES, MAINE

(L. C. Card No. Mic 58-5386)

Dewey Harold Amos, Ph.D.
University of Illinois, 1958

A detailed field and petrographic investigation was made of the plutonic belt of southeastern Maine and southwestern New Brunswick along the Maine-New Brunswick boundary. The emphasis of the investigation was to determine the age and origin of the plutonic rocks. Work was concentrated in the Calais and Robbinston quadrangles, Maine because of the diversity of plutonic rock types and the presence of sediments which could be dated by contained fossils. Both quadrangles were mapped geologically in their entirety.

The Calais-Robbinston area is underlain by metamorphosed sedimentary rocks, volcanic extrusive rocks, sedimentary rocks and several plutonic igneous rocks, chiefly norite, gabbro, diorite and granite. They range in age from Cambro-Ordovician to Upper Devonian. The oldest rocks belong to the Cambro-Ordovician Charlotte group and consist largely of isoclinally-formed quartzites, phyllites, slates and schists. They are chiefly of low-rank metamorphic character but locally, high-grade rocks occur. The Silurian succession consists of two major groups; a thick sequence of interlayered shale and rhyolite extrusives of Middle Silurian age which contain thin, interbedded sediments. Formations of Middle Silurian age recognized were the Oak Bay conglomerate and the Quoddy shale; those recognized of Upper Silurian age were the Pembroke formation and the overlying Eastport formation. The latter

has been subdivided into five members based on lithologic characteristics and stratigraphic sequence. The youngest stratified unit present is the Perry formation of Upper Devonian age. It consists of a thick sequence of coarse clastic sediments containing interbedded basalt flows.

Structural and age relationships indicate that the region has undergone three periods of deformation; post-Cambro-Ordovician—pre-Silurian, post-Middle Silurian—pre-Upper Sillurian and post-Silurian—pre-Upper Devonian. The earliest deformation was intense enough to produce low-grade metamorphic effects on a regional scale. The only effects of the later deformations were folding and faulting.

Prior to this investigation all of the plutonic rocks of the area were considered to be related and to be essentially contemporaneous. Structural and petrographic relationships suggest that the bodies of basic rocks are remnants of a large stratiform body which was emplaced in sediments of the Charlotte group prior to the pre-Middle Silurian deformation. Subsequent transverse faulting and assimilation and replacement by younger plutonic rocks resulted in the present isolated masses. All of the diorites and granites in the area were emplaced in the post-Silurian —pre-Upper Devonian interval as they exhibit intrusive contacts toward rocks of Upper Silurian age and have contributed detritus to the Perry formation of Upper Devonian age. All of the diorites and granites except one, the Red Beach granite, were formed under relatively deep-seated conditions. Petrographic characteristics indicate that they are related and are probably about the same age although granites invariably show intrusive relationships toward diorites. Contact features establish that the Red Beach granite is the youngest; mineralogical and textural features indicate that it formed under near-surface conditions.

The presence of plutonic rocks in a region characterized by low-grade metamorphism suggests that they are of magmatic derivation. Contact and petrographic characteristics confirm a magmatic origin, although locally granitization has operated as a subordinate process. Distribution of the rocks in a linear belt suggests that emplacement may have occurred along a zone of thrust faulting which was traversed by numerous cross-faults.

Microfilm $3.25; Xerox $11.20. 251 pages.

X-RAY STUDY OF BIOTITE FROM THE SCOTT MINE, STERLING LAKE, NEW YORK

(L. C. Card No. Mic 58-5389)

Tin Aye, Ph.D.
University of Illinois, 1958

In this investigation, x-ray methods were used to determine the structure of biotite, the per cent of iron in biotite, and the iron-magnesium ratio in biotite. Thirty-seven biotite specimens were separated from the Scott mine diamond drill cores in the vicinity of magnetite concentrations.

Powder patterns were examined for the preliminary structural analysis. The results showed that all the specimens belong to the one layer monoclinic polymorph. The oscillation, rotation, Weisenberg, and Laue patterns confirm this.

Iron-magnesium ratio was determined by x-ray diffraction using the ratios of the areas occupied by the 004 and 005 peaks. Iron, manganese, potassium, and titanium were determined by fluorescent x-ray analysis and three spectrographically analyzed specimens were used as standards in computing curves of the per cent of these elements.

The iron-magnesium ratio in biotite decreases as the ore zone is approached. Per cent of iron also decreases on approaching the ore bodies. Spectrographical analyses of three biotite specimens show that magnesium increases as iron decreases.

All of these results indicate that biotite may have been one of several ferromagnesium minerals from which iron was removed to form the magnetite ore bodies.

Microfilm $2.00; Xerox $3.00. 60 pages.

STRATIGRAPHY OF THE GAPTANK FORMATION, GLASS MOUNTAINS, TEXAS

(L. C. Card No. Mic 58-5331)

David Arthur Bostwick, Ph.D.
The University of Wisconsin, 1958

Supervisor: L. M. Cline

Fusulinids are used to date units of the Gaptank formation at its type section and at other localities of outcrop in the Glass Mountains of west Texas. Exposures of the Gaptank are presented in diagrammatic section along with the associated fusulinids. Correlations of the Gaptank and overlying lower Wolfcamp beds are made with Pennsylvanian and Permian rocks of the northern mid-continent region, extreme west Texas, north-central Texas, and south-central New Mexico.

The oldest beds of the type Gaptank are dated as early Desmoinesian, the youngest beds as middle Virgilian. Uppermost beds of the Gaptank exposed west of the type area contain fusulinids dated as late Virgilian, and an uneven erosion surface at the top of the Gaptank is indicated. Uplift and erosion of part of the late Virgilian beds of the Gaptank occurred in very late Virgilian or early Wolfcampian time.

In one exposure west of Marathon, both Gaptank beds and early Wolfcampian beds conformably overlying the Gaptank are folded as a result of overriding by the Dugout Creek overthrust sheet. The thrusting is dated as early Wolfcampian but probably continued not later than Neva time. Truncated folds of the Gaptank are unconformably overlain by middle Wolfcampian beds at Dugout Mountain west of Marathon. Here uplift and erosion followed thrusting until marine deposition was resumed in middle Wolfcampian time.

In the vicinity of the Wolfcamp type area the Uddenites zone, previously dated as late Pennsylvanian and included in the Gaptank formation, is dated by the fusulinids as probably very early Wolfcampian. The systemic boundary is placed at the base of the Uddenites zone.

At Black Peak on the west side of the Marathon Basin limestone beds are dated as early Atokan, late Atokan, and Desmoinesian in age. It is concluded that uplift to the south and southeast of Black Peak did not contribute significant quantities of clastics to the area of the southwestern part of the Marathon Basin until after Desmoinesian time.

Microfilm $2.00; Xerox $5.40. 108 pages.

MINERALOGY OF SANGAMON WEATHERING PROFILES

(L. C. Card No. Mic 58-5395)

John Allen Brophy, Ph.D.
University of Illinois, 1958

Four buried Sangamon weathering profiles in Illinois, two developed in till and two in outwash, were studied in the field and sampled for laboratory studies of degree of weathering as indicated by heavy mineral weathering ratios. Mechanical analyses and x-ray analyses of clay minerals (till profiles only) were also made.

Weathering ratios were calculated from counts by polarizing microscope of the heavy minerals of the very fine sand fraction using the form

$$\frac{\text{stable mineral (s) (no. of grains)}}{\text{unstable mineral (no. of grains)}}$$ as follows:

(1) $\dfrac{\text{zircon + tourmaline}}{\text{hornblende}}$

(2) $\dfrac{\text{garnet}}{\text{hornblende}}$

(3) $\dfrac{\text{zircon + tourmaline}}{\text{garnet}}$

Garnet was tried on both sides of the ratio because its stability is debated in the literature. Ratio (1) plotted vs. depth shows only small random changes in the lower zones of profiles but in zones II and I (B and A soil horizons) it averages a three-fold increase for the till profiles and an eight-fold increase for the outwash profiles. Ratio (3) shows only random changes throughout the till profiles but averages a four-fold increase in zones II and I of the outwash profiles. The more advanced weathering of the outwash profiles indicated by these ratios and by deeper oxidation and leaching of carbonates is probably due mainly to the higher permeability of the outwash sediments.

The clay minerals chlorite and illite are nearly completely altered to montmorillonite in zones II and I of the till profiles; chlorite going through vermiculite-chlorite and vermiculite stages, and illite going through a mixed lattice illite-montmorillonite stage.

Microfilm $2.00; Xerox $3.00. 46 pages.

THE GEOLOGY OF THE FREEPORT QUADRANGLE, ILLINOIS

(L. C. Card No. Mic 58-5408)

Frank Larry Doyle, Ph.D.
University of Illinois, 1958

The Freeport Quadrangle is located in northwestern Illinois on the Wisconsin Arch. Ordovician sediments of the Champlainian Series make up most of the bedrock. The St. Peter Formation (oldest) and Glenwood Formation are primarily sandstone units which occur only in the bedrock valleys where they are covered with alluvium. The Platteville Group, argillaceous, shaly dolomite, and the Galena Group, pure, often-cherty and sometimes-shaly dolomite, make up most of the exposed bedrock. This latter group includes the Guttenberg Formation (oldest), fossiliferous with red shale beds; the Dunleith Formation, cherty; the Wise Lake Formation, non-cherty; and, the Dubuque Formation, argillaceous with shale beds. Differentiation of the Dunleith and Wise Lake Formations into their members is often possible. Shale of the Maquoketa Group (Cincinnatian Series) overlies the Galena Group in a small area.

Tectonic features are relatively gentle folds superimposed on a regional dip of about twenty feet per mile to the southwest; the strike is generally northwesterly. No faults were found, other than those produced by ice shove, but sets of joints trend roughly north-south and east-west.

The Pecatonica River, which seems to be a structurally controlled stream in most of the area, is the major drainage. Erosion has produced a submature topography which may represent the Lancaster erosion surface.

Relatively thin drift covers the area; till is often inches thick or only a veneer of pebbles over the weathering residue of the dolomite.

Glacial ice moved into the area primarily by flowage but in many places it shoved and crushed the bedrock and incorporated dolomite within its subglacial load, consequently, till sometimes has streaks of a dolomite breccia. Tilting, folding and faulting of surface beds were caused by the same phenomenon. As the glacier melted, water deposited sand and gravel in the form of kames, kame terraces, kame complexes and eskers or crevasse fillings. Glaciolaccustrine silts commonly occur as terraces or terrace remnants. Most of the narrow segments of modern stream valleys were cut by water which overflowed lakes in preglacial valleys which were dammed by ice and drift; other youthful valleys have similar origins. The abandoned parts of the valleys are usually filled with drift. The complex stratigraphic relations of the glacial deposits, the geomorphic forms they take, the erratic patterns of the drainage changes and an apparent absence of end moraines suggest stagnation of the ice sheet followed by melting in place.

The drift sheet which covers the Freeport Quadrangle is overlain outside the area by the Shelbyville (Tazewell) drift. The amount of erosion of drift and bedrock since glaciation and the weathering of the drift (leaching through loess into till is about four feet and into silts is about six feet) suggest deposition after the Sangamon interglacial interval. These factors indicate that the drift covering the area is most likely of the Farmdale Substage of the Wisconsin Stage. Microfilm $2.00; Xerox $5.60. 112 pages.

GROUNDWATER GEOLOGY OF WINNEBAGO COUNTY, ILLINOIS

(L. C. Card No. Mic 58-5423)

James Edward Hackett, Ph.D.
University of Illinois, 1958

The geology of Winnebago County as it affects or controls the occurrence and availability of groundwater supplies was investigated in field and laboratory studies and maps and figures were drawn to show the distribution and position of the rock types, the buried valleys, and the availability of groundwater from the glacial drift.

The rocks underlying the county are divided into 11 bedrock formations: crystallines of Precambrian age; the Mt. Simon Sandstone, Eau Claire Formation, Ironton-Galesville Sandstone, Franconia Formation, and Trempealeau Dolomite, all of Cambrian age; and the St. Peter Sandstone, Glenwood Formation, Platteville Dolomite, Decorah Formation, and Galena Dolomite, all of Ordovician age. Glacial drift and alluvial deposits of Pleistocene age overlie the bedrock.

The glacial drift consists of deposits of Farmdale subage overlain locally by deposits resulting from other ice advances of Wisconsin age. The fill in the deeply cut preglacial valleys consists chiefly of outwash deposited by glacial meltwater. Where the meltwater drainage in these valleys was directed away from the ice front, the resulting outwash deposits are coarse-textured and permeable.

Four geohydrologic units, that is intervals of the section which possess distinctive features of hydrologic significance, are the glacial drift aquifers of Pleistocene age; the dolomite aquifers of Ordovician age (includes the Galena, Decorah, Platteville and the upper part of the Glenwood Formations); the sandstone aquifers of Ordovician age (includes the lower part of the Glenwood Formation and all of the St. Peter Sandstone); and the Cambrian aquifers (primarily the Ironton-Galesville Sandstone, the lower part of the Eau Claire Formation, and the Mt. Simon Sandstone).

Most of the groundwater withdrawn in the County comes from the Cambrian aquifers and the glacial outwash which occurs as fill in the deep preglacial valleys. Wells drilled into these aquifers normally yield more than 300 gallons a minute each and are the source of water supply for nearly all of the larger industries and municipalities. The aquifers in neither of these units are being used to their full capacity and offer the greatest potential for future groundwater supply development in the county. The present use and the potential of the Cambrian aquifers and the glacial drift aquifers are about equal.

The sandstone aquifers of Ordovician age supply considerable quantities of water to smaller industries and municipalities. Occasionally wells drilled into this unit are used for domestic and stock supplies.

The dolomite aquifers of Ordovician age are primarily used for domestic and stock supplies wherever they have not been removed by erosion. They are absent where valleys are cut through them into underlying formations.

Microfilm $2.00; Xerox $6.60. 136 pages.

STRATIGRAPHY AND SEDIMENTARY PETROLOGY OF JURASSIC AND PRE-GRANEROS CRETACEOUS ROCKS, NORTHEASTERN NEW MEXICO

(L. C. Card No. Mic 58-3986)

Charles John Mankin, Ph.D.
The University of Texas, 1958

Supervisor: William R. Muehlberger

A field and petrologic study of the continental Exeter, Todilto and Morrison (Jurassic) formations in northeastern New Mexico, has revealed their source area, environment of deposition and paleoclimate. The Exeter sandstone, an interior arid-region dune sand, was derived from a northwestern granitic, metamorphic and older sedimentary source. The Todilto limestone, exposed only in the southwestern part of the area, was deposited as a nonmarine, algal limestone. The Morrison formation contains sediments of alluvial flat, fluvial, lacustrine and aeolian environments. The principal source area of the Morrison was from the northwest and similar to that of the Exeter sandstone, although the southern margin of the basin had local contributions. Volcanic ash, bentonite beds, plagioclase laths, quartz phenocrysts, apatite, euhedral zircon, and glass shards indicate volcanic activity in the source area. Vacuolized feldspar, kaolinite, fluvial sandstones, petrified wood and absence of unstable heavy minerals show that the paleoclimate changed from arid to humid during Morrison deposition.

An Early Cretaceous transgression from east to west is represented by the Purgatoire formation. The presence of euhedral (volcanic) zircon in both the upper Morrison formation and the Purgatoire formation indicates depositional contemporaneity during this transgression.

A second marine transgression, also from east to west, is represented by the Dakota formation. Although the source area for the Dakota was the same as for all of the preceding units, the grain size is coarser and zircon is only a minor constituent. The coarser grain size is attributed to a change in relative amounts of contribution from igneous, metamorphic and sedimentary rocks. The coarser mode is attributed to a sedimentary source. The decrease in zircon is a result of cecessation of volcanic activity.

The absence of unstable minerals, abundant silica-cementation and vacuolization of the feldspar indicates a humid paleoclimate for both the Purgatoire and Dakota formations. Microfilm $3.60; Xerox $12.20. 278 pages.

GEOLOGY OF THE SPENCE-KANE AREA, BIG HORN COUNTY, WYOMING

(L. C. Card No. Mic 58-5482)

Robert Lester Rioux, Ph.D.
University of Illinois, 1958

The Spence-Kane area includes about 350 square miles in Big Horn County, Wyoming, on the northeastern side of the Bighorn Basin. The climate is arid, vegetation is sparse, and rock exposures are on the whole excellent. Rocks present in the area range in age from Precambrian to Recent and represent all systems except the Silurian. A section from the Mississippian to the Recent is exposed within the area, the older rocks are known from records of deep wells drilled in the area. The exposed section of sedimentary rocks has an aggregate thickness of about 13,200 feet. The Paleozoic rocks are dominantly marine and average about 3050 feet in thickness. The Mesozoic rocks are both marine and non-marine in origin and have an average thickness of about 8250 feet. The Cenozoic rocks are continental in origin and are about 3700 feet in thickness. The stratigraphy of formations ranging in age from Cambrian to Eocene is discussed in detail and measured sections of many of the units are presented. Fossil collections from various formations are included within the

text. Correlated surface and subsurface sections of many of the formations are illustrated by means of plates. A geologic and structure contour map, with cross sections, and a generalized columnar section illustrate the outcrop pattern, structure, and lithologic sequence of the formations. A number of sandstone dikes are found within the area and their relations to the surrounding formations are described. A number of terraces are found along the major streams and pediment surfaces slope away from the mountain front.

The structure of the area is dominated by two large asymmetrical anticlines, the Sheep Mountain anticline and Little Sheep Mountain anticline, which are prominent topographic features as well. The general structural trend is northwest-southeast. The central part of the area consists of a series of minor folds generally parallel to this regional trend. To the west of this central belt, the rocks dip westward, generally in toward the central part of the Bighorn Basin, while on the eastern margin, the rocks dip westward along the gentle limb of an asymmetrical syncline and rise to the flanks of the Bighorn Mountains. There are twelve anticlinal folds, wholly or partly within the Spence-Kane area. These structures and their relations to the adjoining synclines are described.

Faults within the area are practically all high angle faults that trend northeast-southwest, perpendicular to the general structural trend within the area. Most of these faults are found along the limbs and at the nose of the Little Sheep Mountain anticline, and appear to be tensional in origin. A belt of parallel faults in the southwestern part of T. 55 N., R. 95 W., is related to a larger belt to the northwest associated with the Garland and Byron anticlines. A low angle reverse fault is present along the east flank of Little Sheep Mountain. The Sheep Mountain anticline has few faults associated with it, but sandstone dikes are common about the flanks, which are not found about the Little Sheep Mountain structure. Several of the anticlines are distinctly asymmetrical. Cross sections illustrate the asymmetry of folds and their relationships to one another.

There are three small oil fields within the area. These fields, and oil and gas tests of other anticlines within the area are discussed. Coal, bentonite, clay, gypsum, construction materials, uranium, and iron ore deposits within the area are described and evaluated.

Microfilm $3.50; Xerox $11.80. 270 pages.

STRATIGRAPHY OF UPPER MIDWAY AND LOWER WILCOX GROUPS, WEST-CENTRAL ALABAMA AND EAST-CENTRAL MISSISSIPPI

(L. C. Card No. Mic 58-5084)

Wilfred Francois Roux, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Keith Young

The Midway and Wilcox Groups were deposited at or near sealevel in a slowly and continuously subsiding basin. The net rate of deposition was greater than the net rate of subsidence resulting in a regression of the sea toward the south and southwest. Conditions fluctuated so that there were minor transgressions which seldom regained the area lost to the preceding regression. The accumulated material is a complex of continental, deltaic, and marine deposits. The deposits in Mississippi accumulated nearer the source in continental and deltaic lithotopes, whereas the equivalent units in Alabama were deposited in deltaic and marine lithotopes farther from the source.

The Wilcox disconformity overlies the Midway Group; the contact is a complicated coalesence of a non-marine disconformity in Mississippi and a marine disconformity in Alabama. The basal Wilcox Coal Bluff Formation is separated from the upper Midway Naheola Formation on the basis of predominant grain size, medium and coarser in the Wilcox and fine and finer in the Midway.

The units studied are in ascending order in the Midway Group, the Porters Creek Formation and the Naheola Formation, composed of the Matthews Landing, Oakhill, and Kemper Members, and in the Wilcox Group, the Coal Bluff Formation, consisting of the lower glauconitic and upper nonglauconitic members, and the Nanafalia Formation, composed of the lower ("Ostrea thirsae" beds) and upper ("pseudobuhrstone") members.

Microfilm $3.50; Xerox $12.00. 271 pages.

LATE DEVONIAN AND EARLY MISSISSIPPIAN CONODONT FAUNAS OF THE UPPER MISSISSIPPI VALLEY

(L. C. Card No. Mic 58-5493)

Alan Johnson Scott, Ph.D.
University of Illinois, 1958

Study of more than a dozen conodont faunas from the Kinderhook Series and the overlying Valmeyer Series discloses the presence of nine distinct faunal assemblage zones in the Upper Mississippi Valley. These zones in ascending order are: Palmatolepis (Manticolepis) - Ancyroides; Palmatolepis (Palmatolepis) - Polylophodonta; Spathognathodus (Lateralidentina) - Spathognathodus; Siphonodella duplicata solicarinata; Siphonodella quadruplicata - S. duplicata nodosa; Siphonodella duplicata s.s. - S. duplicata nodosa; Gnathodus - Siphonodella duplicata laevis; Gnathodus - Polygnathus communis ornata; and Gnathodus - Bactrognathus.

These faunal zones correlate with conodont and cephalopod zones in western Europe and provide excellent evidence for placement of the Devonian-Mississippian boundary in the Standard Mississippian Section of western Illinois. Such evidence is especially valuable because sediments in the Kinderhook Series in the type area generally lack diagnostic fossils and most previous correlations have been based largely upon comparison of lithologies. Poorly understood facies relationships and repetition of similar depositional environments have caused some workers to make erroneous correlations between the Kinderhood Series in southeastern Iowa and the type area.

The conodont zones presented here clarify these relationships and indicate that the Devonian-Mississippian boundary should be placed at the base of the Glen Park Formation and that the Champ Clark Group, which includes the Sylamore, Grassy Creek, Saverton and Louisiana formations, be considered the youngest Devonian series in Illinois.

Clarification of the taxonomic relationships of conodonts utilized for biozone correlation has resulted in the establishment of four new varieties, one species, one subgenus and one family (Spathognathodidae). In addition the concepts of classification used in this study allow rather broad limits for specific variation and result in the inclusion of many previously narrowly drawn species into a relatively few broadly drawn species.

Correlation with Upper Devonian and Lower Mississippian units of other North American areas is suggested where knowledge of the conodont faunal sequence is sufficiently well known.

Microfilm $2.85; Xerox $9.80. 218 pages.

RECONNAISSANCE GEOLOGY AND GROUND WATER STUDY OF A PART OF SOCORRO COUNTY, NEW MEXICO

(L. C. Card No. Mic 58-2521)

John Francis Waldron, Ph.D.
Stanford University, 1957

The area, about 200 square miles in extent in the Basin-and-Range Province in central New Mexico, consists of two partially enclosed alluvial basins separated by a mountain range. The upper basin or Snake Ranch Flats, flanked on the west by the Magdalena Mountains, is about 1,500 feet higher than the lower basin or Rio Grande Valley, flanked on the east by the Joyita Hills. The Socorro-Lemitar Mountains is a partial barrier to surface and ground water flow from the upper to lower basin.

This study concerns: (1) the relationship of ground water to the rocks and geologic structure of mountains and basins; (2) the sources of ground water recharge and sinks of discharge; (3) the water levels and water level gradients; and (4) the causes for variations in chemical quality of ground water.

Both basins are drained by the perennial master stream, the Rio Grande, and its tributaries, except for one small area of interior drainage in the north-central Flats. Successive lowerings of base level of the river have produced a set of peripediments, remnants of which are preserved as small hills close to the mountains or as lobate tongues continuous from mountains to the river along the transmountain drainage systems of Sedillo, Nogal, and San Lorenzo Arroyos. The peripediments are correlative with others in the Rio Grande Valley in New Mexico. Landsliding is extreme in the Socorro Mountains.

The Socorro-Lemitar Mountains are composed of Precambrian igneous and metamorphic rocks, Paleozoic marine sedimentary rocks, and Tertiary volcanics. Quaternary-Tertiary continental sediments cropping out in the Socorro Mountains and on the flanks of the Lemitar Mountains are correlative with Middle and Late Tertiary sediments in the Rio Salado Basin to the north. The basins are filled to an unknown depth, at least 550 feet, by Quaternary-Tertiary sediments.

The Socorro-Lemitar Mountains have been block-faulted on longitudinal and transverse normal faults with throws up to 3,500 feet. Precambrian, Paleozoic, and Tertiary volcanic rocks have been moderately tilted to the west, and Quaternary-Tertiary sediments have been slightly to moderately arched, tilted, folded, and faulted. Degree of deformation of sediments increases with proximity to the mountains. The Snake Ranch Flats is probably an asymmetrical basin, the axis of the trough being close to the battered fault scarp of the Magdalena Mountains. The Rio Grande Valley may be a graben instead of an asymmetrical basin, the depth of the basement complex being as much as 5,800 feet. Small fault scarps in alluvium indicate renewed activity along major fault zones.

Ground water in the Flats, principally recharged from the Magdalena Mountains, migrates northward to the Rio Salado Basin and eastward through Nogal and Sedillo Canyons. Ground water migrating southward in the valley is principally recharged by the river and locally from Nogal Canyon. Other local sources are indicated south and west of Socorro. According to chemical quality and history of flow, the Socorro spring may be recharged by groundwater from the Flats. Stages of the Rio Grande and water levels in floodplain aquifers are closely related.

Chemical quality of ground water is excellent in the Flats and variable in the valley. Water in the uppermost floodplain aquifer is highly mineralized while water in the lower aquifers is of good quality. Sodium, chloride, and sulfate are principal constituents in the northern part of the valley, while calcium and bicarbonate typify the water to the south. Two-source and three-source mixing of ground waters occur in the valley as indicated by diagrams devised by the author to interpret variation in quality of water. Microfilm $3.90; Xerox $13.20. 302 pages.

GEOLOGY OF THE COBAN-PURULHA AREA, ALTA VERAPAZ, GUATEMALA

(L. C. Card No. Mic 58-5097)

Jack Louis Walper, Ph.D.
The University of Texas, 1958

Supervisor: Fred M. Bullard

The Coban-Purulha area, comprising approximately 400 square miles in central Guatemala, lies in the folded and faulted front ranges of the Central Mountain System which extends eastward from Chiapas, Mexico, across Guatemala and into the Caribbean Sea.

The outcropping rocks are of Paleozoic and Mesozoic ages. The Tactic and Chochal formations consisting lithically of shale and limestone respectively, are of Permian age and comprise the oldest stratigraphic sequence. Unconformably overlying the Chochal formation is a sequence of continental deposits, the Todos Santos formation, of Jurassic-Cretaceous age. These are conformably overlain by a thick limestone sequence of Cretaceous age which is subdivided into a lower Ixcoy formation and an upper Coban formation.

Nomenclatorial problems encountered were dealt with by proposing the new name Tactic for lower Permian shales which have been erroneously called Santa Rosa, discarding the name Santa Rosa in favor of Todos Santos for the continental beds, and the redefinition of the Ixcoy and Coban formations.

Folding has produced, in addition to a large east-west trending anticlinorium, a number of anticlines and synclines

which are complexly fractured. The area is cut by a zone of major east-west faulting which appears to align with the north boundary fault of the Cayman Trench (Bartlett Trough) in the Caribbean Sea.

The thick sequence of limestone, which has been extensively fractured when folded, together with the heavy rainfall, has given rise to an exceptional well developed karst topography.

Microfilm $2.00; Xerox $7.00. 149 pages.

HEALTH SCIENCES

HEALTH SCIENCES, PATHOLOGY

A STUDY OF THE PATHOGENESIS OF THE ANEMIA IN ACUTE ANAPLASMOSIS

(L. C. Card No. Mic 58-3861)

William Elihu Brock, Ph.D.
The University of Oklahoma, 1958

Major Professor: Walter Joel, M. D.

Hematological changes in the peripheral blood and bone marrow, the pathology of the liver, and the production of fecal urobilinogen were studied in 10 cattle undergoing the initial attack of anemia in anaplasmosis.

The anemia was demonstrated to be of a normocytic normochromic type during the first 6 to 8 days prior to erythropoietic response in the bone marrow. Following increased erythropoiesis, the anemia became macrocytic hypochromic in character. As the anemic condition was gradually corrected the erythrocytes returned to normal.

The anemia was principally due to hemolysis of the infected erythrocytes. Depression of the percentage of erythroblasts in the bone marrow during the last 15 days of the incubation period may indicate some contribution of decreased erythropoiesis to the anemia. It is felt, however, that the erythroblastic depression was largely relative, and a reflection of increased granulocytopoiesis.

The liver remained essentially undamaged during the period of greatest hemolysis, and was able to process the bilirubin produced. Only after the anemia became severe was the liver damaged, with consequent bile retention and icterus. Hemolysis at this time is reduced to almost normal. The icterus, therefore, is due more to liver damage than to hemolysis.

Microfilm $2.00; Xerox $5.20. 101 pages.

STUDY OF THE ARRANGEMENT AND BEHAVIOR OF THE RETICULAR FIBRILS OF THE SPLEEN IN THE LEUKEMIAS

(L. C. Card No. Mic 58-3869)

Wilma Jeanne Green, Ph.D.
The University of Oklahoma, 1958

Major Professor: Walter Joel, M. D.

One hundred twenty spleens, from patients who died of leukemia or closely related disorders, were sectioned and stained with hematoxylin-eosin, Goldner's modification of Masson's stain, Gomori's methenamine silver stain, and PAS-Hale stain. These spleens were carefully examined and their reticular and protoplasmic fibrillary patterns were compared with at least two non-leukemic spleens from patients of comparable age.

The Malpighian corpuscles of the great majority of the leukemic spleens contained an increased amount of reticular fibrils which separated the cells into small groups. In the periphery of the body the reticular fibrils were increased and often individual cells were encircled. Cases in which the disease was of very short duration, a few weeks, usually manifested a normal, corpuscular, fibrillary pattern. When the Malpighian body was represented by a follicular artery surrounded by leukemic cells, the argentophilic fibrils were coarse, increased and very much like those of bodies not so markedly infiltrated. However, in many instances the reticular fibrils of the body completely disappeared.

The red pulp of the leukemic spleens displayed great variation in amount and arrangement of reticular fibrils. In cases of short duration, often the argyrophile fibrillar arrangement was normal and the sinuses were delineated well with latticed fibrils between them. With prolongation of the disease very few sinuses were recognized and the cells between them were separated into small nests by reticular fibrils. In other spleens sinuses were not discernible. The cells of the red pulp in these sections were enmeshed in a maze-like arrangement of reticular fibrils and often cells were encircled individually. In chronic leukemia the argentophilic fibrils had a tendency to be frayed or split. These extremely fine threads ran across cells and gave the area a gray appearance.

The Malpighian corpuscles in lymphosarcoma, reticulum cell sarcoma and Hodgkin's disease usually resembled the ones found in leukemic spleens. The non-tumorous portion of the red pulp presented a normal amount and arrangement of reticular fibrils. The tumor areas exhibited many coarse and fine argentophilic fibrils which ran across and between cells.

It is concluded that: (1) Malpighian corpuscles in leukemic spleens contain a marked increase of reticular fibrils which may ultimately disappear. (2) The argentophilic fibrils of the red pulp may be normal in acute leukemias, but in the chronic leukemias the sinuses often are not recognized. (3) The reticular fibrils form a fine-meshed maze arrangement.

Microfilm $2.00; Xerox $5.60. 112 pages.

HEALTH SCIENCES, PHARMACY

A PHARMACOGNOSTIC STUDY OF WITHANIA SOMNIFERA DUNAL

(L. C. Card No. Mic 58-3899)

Chand Kumar Atal, Ph.D.
The University of Connecticut, 1958

The roots of Withania somnifera Dunal. have been used in India as a sedative, hypnotic and as an ingredient of certain tranquilizer drugs. A literature survey revealed that the drug had not been sufficiently characterized, chemically or morphologically.

The roots from commercial sources as well as from authentic plants were compared as to their macroscopical and microscopical characters. It was found that the commercial roots compared well with the roots of young plants with the exception of certain details of xylem. Both showed a poorly developed cork, a secondary cortex of 6 to 16 layers of parenchyma, a narrow phloem showing radial strands of sieve tissue separated by phloem rays and an abnormally developed xylem composed of abundant parenchyma with scattered groups of xylem vessels. Microsphenoidal crystals, abundant starch grains with characteristic hilii and presence of interxylary phloem was also common to both commercial and young roots. The only point of difference was the number of xylem vessels in the scattered groups which in the case of commercial roots was 1 to 3 and in the case of roots from young plants was 3 to 7.

The lateral thin roots from young plants and the roots from old shrubby plants always showed a central solid core of xylem which was composed of numerous fibers, tracheids and large xylem vessels. There was complete lack of non-lignified parenchyma in the xylem.

Microscopical features of stem, often present in commercial samples, showed a cuticularized epidermis, a two layered hypodermis, cortex divisible into an outer collenchymatous and an inner parenchymatous zone, lysigenous reservoirs at the junction of cortex and phloem and the intraxylary phloem.

In the phytochemical studies, the ground commercial drug was extracted with aqueous alcohol. During concentration large amounts of sucrose and potassium nitrate were isolated. The vacuum dried extract was divided into an acid soluble and an acid insoluble fraction by the use of a 2.5% aqueous tartaric acid solution. The acid insoluble fraction after being freed of fatty material by extraction with petroleum ether, was extracted with chloroform. The chloroform extract yielded a neutral white crystalline material identical to withaniol and further gave a weakly basic, white microcrystalline alkaloid which was designated as alkaloid A. Alkaloid A had an empirical formula $C_{22}\ H_{38}\ N_1\ O_4$ and did not seem to belong to any of the known groups of solanaceous alkaloids. It gave amorphous addition complexes with gold chloride and Mayer's reagent but gave no crystallizable salt.

The acid soluble fraction on extraction with chloroform at an acid pH gave a further quantity of alkaloid A and a neutral compound not identical with withaniol. The acid soluble fraction remaining after the above treatment, on extraction with chloroform at an alkaline pH gave a mixture of at least five alkaloidal materials, the major component of the mixture being a brown unstable material. The acid soluble fraction after the last manipulation was adjusted to a pH of 4 and the quarternary bases were precipitated as the reineckate. The reineckate on reconversion to alkaloidal hydrochloride yielded a mixture of two brown bases.

An attempt to confirm the presence of nicotine utilizing paper-chromatographic techniques and alkaline steam distillation of the drug, was not successful. In an investigation of the berries of Withania somnifera, the presence of proline, valine, alanine, tyrosine and glycine was shown by paper-chromatographic procedures.

Microfilm $2.00; Xerox $5.20. 103 pages.

A COMPARISON OF THE ANTIBACTERIAL ACTIVITY OF ERYTHROMYCIN IN VARIOUS SUPPOSITORY BASES

(L. C. Card No. Mic 58-3479)

Charles William Blissitt, Ph.D.
The University of Florida, 1958

Suppositories have been employed as a dosage form for the administration of medicinal agents since ancient times. Most of the early excipients seem to have been regarded only as a convenient means of introducing medicinal agents into body orifices without regard to the ultimate fate of the drug.

The purpose of this investigation was to compare four representative suppository bases as vehicles for an antibiotic material, erythromycin. Bases were evaluated both for the antiseptic activity and stability of the erythromycin contained within the various vehicles when tested against a strain of Micrococcus pyogenes var. aureus.

A master batch of 84 suppositories each containing 50 mg. of erythromycin was prepared from each base. The bases tested were as follows: cocoa butter (Base I); cocoa butter with one per cent Aerosol O. T. (Base II); Carbowax 1500 and 4000, equal parts (Base III); and polyoxyethylene-stearate with three per cent white wax, five per cent water, and five tenths per cent Aerosol O. T. (Base IV). The agar cupplate method of the U. S. Food and Drug Administration was employed in the determination of antiseptic activity. Using this method, all suppositories showed an antiseptic activity over a five month testing period. However, Base III exhibited the greatest effect in that all growth was inhibited. In the stability test, the data obtained were subjected to a statistical analysis using the Student-Fisher "t" test employed at a 95 per cent confidence level. The erythromycin was stable over a five month testing period in all vehicles with the exception of Base IV where a loss of activity was noted at the end of one month of storage.

Microfilm $2.85; Xerox $9.80. 219 pages.

THE PRODUCTION AND GROWTH OF RYE EMBRYO CALLUS

(L. C. Card No. Mic 58-3905)

David P. Carew, Ph.D.
The University of Connecticut, 1958

The purpose of this investigation was to obtain undifferentiated tissue (callus) from rye (Secale cereale) embryos for demonstrating the host-parasite relationship of Claviceps purpurea and rye.

Embryos of three varieties of Secale cereale, namely Canadian Spring, Rosen, and Tetra Petkus were used in the study. These embryos were aseptically removed from the immature seeds and placed on nutrient agar in glass culture tubes.

Two basic media were employed, White's and Heller's Modified, and many modifications of these basic media were made to determine what effect they would have on the initiation and rate of growth of callus tissue. Such materials as sucrose, coconut milk, yeast extract, indoleacetic acid, 2,4-dichlorophenoxyacetic acid and others, were employed in various concentrations in media. Also such conditions as temperature, light, and pH were varied to determine what effect these might exert on growth.

Certain experiments were carried out to compare the effect of autoclaved and non-autoclaved constituents on callus tissue formation and growth rate.

Callus tissue was produced on many different media. The time for onset of callus growth varied among media. In general, once callus tissue was produced its period of active growth was about twenty-five days.

Callus tissue has been continually maintained for a prolonged period of time through periodic transplanting or subculturing to fresh media.

Of the numerous media used in the study, Heller's Modified media plus yeast extract, 2,4-D and 2.0 per cent sucrose gave best results. Callus tissue subcultured to this media underwent an average increase, on a fresh weight basis, of 143.0 per cent in twenty-five days.

Autoclaved coconut milk favored callus formation as compared to the non-autoclaved product. However autoclaved yeast extract did not favor callus growth to the extent that non-autoclaved material did. The position of the embryo had an effect on callus growth. When the embryo was placed with the ventral surface of the scutellum away from the surface of the media, more callus tissue was produced.

The callus growth was mainly of two types. One type of tissue consisted of large, irregularly shaped, loosely arranged cells. A second type was a much more compact type of tissue wherein the cells were more rounded and had fairly well-defined nuclei. Often there occurred areas of tissue intermediate in structure to those two types.

Callus tissue, which was growing on several different media for prolonged periods, was infected with a culture of Claviceps purpurea. After several days the tissue was fixed, sectioned, and stained. A microscopic study revealed that there was definite penetration of the callus tissue although there was no apparent invasion of the individual cells.

Qualitative examination of the ergot-infected callus tissue for the presence of alkaloids gave negative results.

Microfilm $2.00; Xerox $3.80. 66 pages.

A COMPARISON OF THREE SELECTED MEDICO-ECONOMIC ENVIRONMENTS AND THEIR EFFECT ON PRICES PAID BY CONSUMERS FOR SELECTED PHARMACEUTICALS

(L. C. Card No. Mic 58-5344)

Dieter Wilhelm Grimm, Ph.D.
The University of Wisconsin, 1958

Supervisor: Associate Professor William S. Apple

Politicians in various countries have considered it their responsibility to bring to their people various forms of governmentalized health schemes generally known as semi-socialized and socialized medicine. Great Britain was selected as an example of socialized medicine, West Germany as an example of semi-socialized medicine, and the United States as an example of free medicine.

1. This study investigates the prices of fifteen selected drugs, which are common to all three countries. In order to compare the prices paid by consumers for these drugs the coal miner and the garment worker were selected and their hourly wages were translated into minutes of worktime required to purchase the selected drugs. These two occupational groups are comparable in all three countries, representing a typical male occupation and in the case of the garment workers a more female occupation.

The total worktime required in minutes, to purchase all the selected drugs in the three countries as of August 1957 is shown below and for comparison reasons the United States figures were given an index of 1.00.

	Germany	Britain	U.S.A.
Coal Miner:	1996 min.	1736 min.	875 min.
	2.28	1.98	1.00
Garment Worker:	2664 min.	2521 min.	1424 min.
	1.87	1.77	1.00

2. The price indices for pharmaceuticals starting with the year 1950 were compared in the United States, Great Britain, and West Germany, whereby the drug price index for West Germany was obtained from the Association of the Substitute Panels in West Germany since these figures are not yet published by the German Pharmaceutical Association.

Drug price indices for 1956 were 154.8 for West Germany, and 154.5 for Great Britain, respectively, but the drug price index for the United States advanced to only 142.3.

3. The profession of pharmacy in Europe enjoys a certain degree of government protection which cannot be said for the United States pharmacist. In most cases the European pharmacy has a higher prescription volume than the American pharmacy and consequently the distribution costs are higher in the United States than in Europe.

We found that the average retail mark-up for the specified selected drugs were as follows:

	U.S.A.	Britain	Germany
Mark-up:	59%	32%	37%

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

While the retail mark-up is higher in the United States than in Great Britain or West Germany, prices paid by the consumers for selected pharmaceuticals are lowest in the United States because manufacturing costs and intermediate distribution costs are lower.

4. Until it becomes possible to investigate production costs in the three selected medico-economic environments no definite conclusion can be drawn. However this study seems to indicate for the selected occupational groups studied, that the medico-economic environment existing in the United States is more favorable than in Great Britain and West Germany. Microfilm $2.00; Xerox $5.60. 111 pages.

AN EVALUATION OF THE ABSORBTION OF RADIOACTIVE SODIUM IODIDE FROM VARIOUS OINTMENT BASES BY MEANS OF A CHICK EMBRYO TECHNIQUE

(L. C. Card No. Mic 58-3931)

John Salvator Ruggiero, Ph.D.
The University of Connecticut, 1958

This investigation was conducted in order to develop a procedure by which one could evaluate the absorption of medicinals from ointment vehicles.

A method was developed which measures the percentage of absorption of radioactive sodium iodide by eleven-day-old chick embryos. Penetration of the isotope was measured from the ointment base through the shell membrane and chorioallantoic membrane of the chick embryo to their thyroid glands.

Ointments containing radioactive sodium iodide were placed in standard sized rings and carefully transferred to the shell membrane of eleven-day-old chick embryos. The embryos were incubated for a period of forty-eight hours and then their thyroid glands were removed. After macerating the thyroid glands in a 10% sodium hydroxide solution and then allowing the solution to dry, the thyroids were assayed for radioactivity. The amount of radioactivity found in the thyroid glands was then reported as a percentage of the total amount of radioactivity applied.

Forty-seven ointment bases were evaluated for their ability to release radioactive sodium iodide when subjected to the proposed test conditions.

A hydrophilic ointment base consisting of:

Stearyl Alcohol	25.0%
White Petrolatum	25.0%
Propylene Glycol	12.0%
Pluronic L62	0.5%
Pluronic L64	0.5%
Purified Water	37.0%

indicated the highest percentage of release of radio-iodide when evaluated by the proposed method.

In general, ointments of the Hydrophilic type indicated better release of the isotope than did bases of the Absorption or Oleaginous type.

A study was conducted to determine the effect that the addition of water to Hydrosorb Ointment Base would have on the release of radioactive sodium iodide. It was found that the addition of water decreased the percentage of absorption of the isotope from the Hydrosorb Base.

After incorporating various surface active agents into the same basic hydrophilic ointment formula and evaluating each by the proposed method, it was found that the absorption of radioactive sodium iodide was different from each of the ointment bases studied. The differences in absorption could probably be attributed to the various surface active agents used.

Microfilm $2.00; Xerox $3.00. 50 pages.

MANOMETRIC STUDY OF CLAVICEPS PURPUREA (FRIES) TULASNE AND CLAVICEPS LITORALIS KAWATANI

(L. C. Card No. Mic 58-3932)

Emil John Staba, Ph.D.
The University of Connecticut, 1958

The Warburg manometric procedure, direct method, was used in an attempt to obtain a further insight into the biochemical behavior of Claviceps to certain substrates. The experiments performed concerned themselves with: (1) tryptophan adaptation and cell-free enzyme preparation, (2) tricarboxylic acid intermediates, carbon dioxide production, and respiratory quotient, (3) tyrosine and catechol oxidation, (4) transamination.

Claviceps purpurea tissue, acetone powders, and levigated tissue, previously adapted for various periods of time to different media containing tryptophan, erratically oxidized tryptophan, kynurenine, anthranilic acid, and kynurenic acid.

Starvation for 0.5 to 18 hours, treatment of the tissue with liquid nitrogen, lysozyme or digitonin solutions, did not substantially increase the oxidation of various substrates by C. purpurea tissue. Effective transfer of respiratory activity to the supernatant liquid of acetone powders or lyophilized tissue, but not tissue removed from media, was accomplished with powdered glass or alumina.

Unadapted C. purpurea tissue, at various stages of growth from various media, slowly, but consistently oxidized mannitol. The oxygen uptake of such tissue was possibly depressed by the addition of tryptophan, and erratically affected by the addition of kynurenine, anthranilic acid, and kynurenic acid.

C. purpurea sclerotia, previously maintained in a nutrient media for a short period of time, oxidized mannitol well. Very poor endogenous activity was observed in sclerotia recently removed from rye plants, and in an acetone powder made with such sclerotia.

C. purpurea tissue from a media containing α-ketoglutaric acid as a principle component, did not appear to oxidize many of the citric acid cycle intermediates, even when diversified cofactors were added, or when observed over a prolonged period of time.

Because of the slow rate of oxidation of mannitol, and unobserved oxidation of various citric acid cycle intermediates, the possibility of the existence of an anaerobic cycle was investigated. In the experiments conducted for carbon dioxide production by C. purpurea, a large amount of carbon dioxide was observed to be produced with dextrose

as a substrate but not with mannitol. However, the quantity of metabolic carbon dioxide produced with 10 μM of dextrose as the substrate was in excess of that required for the theoretical conversion to 20 μM of alcohol. The precise explanation of the compound(s) formed during the known excessive carbon dioxide production with dextrose could not be concluded from the data obtained.

Further verification of an excessive production of carbon dioxide with dextrose, but not with mannitol, was obtained from calculated respiratory quotient values.

Catechol was not observed to be oxidized by C. purpurea grown in various media, or by C. purpurea sclerotia. The endogenous respiration of C. purpurea acetone powder preparations was suppressed by the addition of catechol. The observed ability of the pigmented strain C. litoralis to oxidize catechol, and the pigmented sclerotia from C. purpurea not to oxidize catechol was an unexpected observation.

Potentiation of tyrosine oxidation by C. purpurea preparations by the addition of α-ketoglutaric acid, pyridoxal phosphate, or sodium arsenite was not successful.

A transaminase enzyme activity could not be demonstrated with various tissue preparations of C. purpurea. Manometric analysis was performed with Clostridium Welchii glutamic decarboxylase enzyme powder.

Microfilm $2.00; Xerox $5.20. 104 pages.

HEALTH SCIENCES, PUBLIC HEALTH

SEROLOGICAL RESPONSES OF COTTON RATS AND WHITE RATS IN RELATION TO THE EXTENT OF INFECTION WITH LITOMOSOIDES CARINII (TRAVASSOS, 1919) CHANDLER, 1931

(L. C. Card No. Mic 58-3960)

Norman Theodore Briggs, Ph.D.
The University of Texas, 1958

Supervisor: Dr. J. Allen Scott

Infective larvae of Litomosoides carinii given to the cotton rat complete migration to the pleural cavities of this normal host within seven days following subcutaneous infection. Recoveries of these larvae in the form of developing worms average 40 - 50% after the first week of infection. Cotton rats harboring these developing worms have been shown to form antibodies demonstrable by the formation of characteristic oral precipitates on infective larvae incubated in sera from hosts with active infections. Following multiple infections with larvae, cotton rats produce strongly reactive sera, and such animals have been shown to resist further infection by stunting the growth and development of challenging worms. The number of these challenging worms which complete migration is not appreciably different from that for animals infected for the first time. When worms which had developed seven days in cotton rats were transferred to other cotton rats, the recipients produced negligible serological responses in spite of the fact that approximately 40% of the worms survived in the latter animals.

In contrast, the mature white rat shows a strong natural resistance to migrating larvae of this parasite. Less than 10% of the infective larvae introduced subcutaneously into this abnormal host are recovered from the pleural cavities 7 to 30 days after infection. Worms that do complete migration undergo very little growth and development. Weak serological responses resulted from primary infections of both cotton rats and white rats. Neither host produced detectable antibodies until after the first week of infection during which period migration of larvae is completed in the normal host. Following multiple infections of white rats strong serological responses are developed in the virtual absence of recoverable worms.

Daily cortisone injections altered the natural resistance of the white rat to migrating larvae. Worms recoveries (38%) from such animals approached those expected from the normal host, and the growth and development of these worms exceeded that observed for worms from control white rats. On the other hand, a residual resistance was evidenced by the fact that worms did not grow or develop as well as worms of the same age from cotton rats. It is suggested that at least a part of this resistance can be associated with a delayed entry of worms into the pleural cavities of treated white rats. Associated with this greater susceptibility to infection was a suppression of antibody responses in treated animals.

Although pretreatment with daily injections of cortisone (50 mg./kg.) beginning 6 to 10 days before infection suppressed the antibody response of white rats, injections at a lower dosage level (30 mg./kg.) did not consistently affect humoral responses when such treatment began on the day of infection. Cortisone dosages at either level were effective in depressing the natural resistance, and pretreatment was not required to produce this effect. None of the animals treated according to these various schedules showed a complete suppression of resistance.

The results of serological testing of cotton rats and white rats are discussed in the light of the findings reported here and elsewhere concerning the course of infections with L. carinii in normal and abnormal hosts.

Microfilm $2.00; Xerox $5.60. 111 pages.

SUSPENDED SOLIDS AS A LIMITING FACTOR IN THE DISINFECTION OF PRIMARY SEWAGE SLUDGE WITH CHLORINE

(L. C. Card No. Mic 58-3966)

Donald Allen Dreyer, Ph.D.
The University of Texas, 1958

Supervisor: Cecil H. Connell, Ph.D.

Experiments were performed to study the limiting influences of suspended solids in the disinfection of primary sewage sludge with chlorine.

The sludge samples used were collected from Galveston and LaMarque, Texas and ranged in suspended solids from 0.11 to 2.49%. These samples were homogenized in 2-liter portions for two minutes at 13,000 r.p.m. in a one gallon Waring blendor.

Chlorine dosage was in the form of hypochlorous acid and chlorine contact time was for a period of two hours

accompanied with gentle stirring. A stipulated reduction to a most probable number of coliform bacteria to below 100/100 ml was consistently obtained when chlorine dosages and residuals were sufficiently high. In sludge samples containing up to approximately 1% suspended solids, chlorine dosages sufficient to effect 2-hour residuals of at least 20 mg/1 reduced the coliforms to fewer than 100/100 ml. With increased suspended solids there was an increased required dosage and residual to effect similar MPN levels; however, based on grams of chlorine per 100 grams of solids, there was not a great increase in the required dosage.

In these experiments, it was found that homogenization was necessary to break up the larger solids before the bacteria could be sufficiently exposed to the chlorine. A homogenization period of two minutes seemed to be sufficient in these studies.

It was noted that there was a rapid chlorine demand and reduction in coliform numbers during the first few minutes of contact, but a period of two hours was necessary to reduce the coliforms to the desired levels.

The chlorine residual as measured indicated a much greater residual requirement with increased suspended solids, but when residuals were measured on the supernatant of such samples the soluble residuals were found to be usually less than 20 mg/1. This indicated that there was a reaction occuring in which the chlorine was tied up with the solids to produce measurable but less colicidal or less available chlorine compounds than the chloramines.

The suspended solids of primary sewage sludge therefore limited the disinfection effectiveness of chlorine in necessitating the use of homogenization to break up the large particles which protect the bacteria from the chlorine, and by combining with the chlorine to produce chlorinous materials of low colicidal activity and/or availability. Microfilm $2.00; Xerox $3.00. 54 pages.

HISTORY

HISTORY, GENERAL

OFFICIAL ENGLISH MARITIME EXPLORATIONS 1660-1780: A STUDY OF THE BEGINNINGS OF SCIENTIFIC EXPEDITIONS

(L. C. Card No. Mic 58-5082)

Glen Morris Rodgers, Ph.D.
The University of Texas, 1958

Supervisor: Walter Prescott Webb

For Europeans the sixteenth century was the great age of discovery and exploration; by the middle of the seventeenth century they had found the major land masses and charted the routes to the principal sources of wealth. English explorers, operating privately, joined in the search for New World riches, and for them the Elizabethan Age was a period of high adventure and romance. After the restoration of King Charles II, English mariners began a new age of exploration primarily under government sponsorship. From 1660 to 1780 the nature of official English maritime enterprises evolved from voyages dispatched for discovery of new lands and markets to organized scientific expeditions aimed at making geographical discoveries, expanding commerce and trade, and increasing knowledge. In tracing that evolutionary process, four points have been considered: where the explorers went, what motivated them, what they found, and how their discoveries affected the development of science in England and the Anglo-American colonies.

Under orders to open trade with the Spanish and to find the Pacific entrance to the northwest passage, Captain John Narbrough sailed up the west coast of South America and returned to England (1669-1671). In 1676 Captain John Wood sought the northeast passage around Russia. Edmund Halley commanded the first English scientific expedition (1698-1701), observing magnetic variations in the South Atlantic and searching for the great southern continent. Captain William Dampier sailed north of Australia and to New Britain (1698-1700) looking for geographical discoveries and whatever might be beneficial to the nation.

The Admiralty pushed Pacific explorations during the middle decades of the eighteenth century. In 1741-1742 Captain Christopher Middleton hunted the northwest passage through Hudson's Bay, and in 1740-1744 Captain George Anson commanded a naval force against the Spanish in the Pacific. With instructions to strengthen England's honor as a maritime power, to advance trade and navigation, and to search for the northwest passage or the southern continent, Captains John Byron (1764-1766), Samuel Wallis (1766-1768), and Philip Carteret (1766-1769) circumnavigated the globe without notable success. Sailing for similar reasons, Captain James Cook made three voyages into the Pacific between 1768 and 1780. Cook succeeded where others had failed: he explored and charted the remaining unknown areas, exploded the myths of the great continent to the south and an accessible Pacific entry to the northwest passage, and collected scientific materials and information.

Cook's initial voyage, to Tahiti for observations of the transit of Venus in 1769 and into high southern latitudes to search for Terra Australis Incognita, was the first organized English scientific expedition; it was financed by the Royal Society, Joseph Banks who went along as botanist, and the Admiralty. That voyage established the pattern for subsequent enterprises financed completely by the government for economic purposes and for collection of scientific data.

The results of the explorations stimulated the development of science; likewise scientific progress motivated the dispatching of further expeditions. Needs for improved navigation caused the establishment of Greenwich Observatory, intensified efforts to determine longitude at sea, and ultimate organization of the Hydrographic Department. Mariners supplied observations and specimens to the Royal

Society; in turn the Royal Society influenced further exploration. Collectors increased the stock of plants and specimens in Kew Botanical Gardens and the British Museum; those scientific institutions promoted not only more extensive collections but also the study of plant and animal distribution. Exotic specimens enabled John Ray and Carl Linnaeus to perfect their systems of classification. Scientific developments in England produced parallel developments in the Anglo-American colonies, and when the colonies became the United States, American explorers and scientists worked from established precedents.

The search for new lands and markets motivated explorations, and wealth from increased trade and commerce made possible governmental support for scientific expeditions. The ultimate results were practical improvements for man's welfare and more extensive knowledge of the physical world.

Microfilm $4.45; Xerox $14.80. 345 pages.

THEORIES OF RESPIRATION IN THE SEVENTEENTH CENTURY

(L. C. Card No. Mic 58-3859)

Leonard Gilchrist Wilson, Ph.D.
The University of Wisconsin, 1958

Supervisor: Robert C. Stauffer

An Historical Account of Theories of Respiration in Relation to Anatomical Knowledge from the Greeks through the Seventeenth Century

This study shows how the theories of respiration inherited from the ancient Greeks, mainly through the works of Galen, were influenced in the seventeenth century by the discovery of the circulation and succeeding discoveries. The Greek concepts are analysed and their development studied. Particular attention is given to the theories, sometimes conflicting, of Galen. The independent discovery of the pulmonary circuit of the blood by Ibn an-Nafis, Michael Servetus and Realdus Columbus is discussed and a comparison is made of the observations upon which their discoveries are based. A common literary root for the discoveries of all three is suggested in Galen, De usu partium Book VI, Chapter 10. The immediate impact of the idea of a pulmonary circuit of the blood on the theory of respiration is shown, particularly in the case of Columbus and Harvey. The discovery of the structure of the lungs, and of the existence of the capillary blood vessels by Malpighi;--the discovery of the need for a constant supply of fresh air in respiration by Hooke;--the discovery of the colour change of the blood in the lungs, as a result of its contact with the air, by Lower;--and the discovery by Mayow that a portion of the air, identical with that consumed by fire, is removed in respiration, are all examined and discussed. The disproof, by Swammerdam, Steno and Borelli, of the mistaken physiological concepts of Descartes, with regard to the heart, is outlined.

The thesis of this study of the discoveries, in connection with respiration, in the seventeenth century, was that they served to define the problem of respiration clearly for the first time. Mayow's work showed beyond doubt that respiration and combustion were analogous processes, using an identical portion of the air. At the same time all evidence for a fire in the heart was destroyed, so that respiration became a function associated not with the heart, but with the blood. It thus became a function, not of any one organ, but of the whole body. As a result consideration of the problem of respiration tended to shift from the heart and lungs of the living body to the air. Respiration became transformed from a biological to a chemical problem. This transformation then laid the foundation for the studies of the air and of gases which were pursued in the eighteenth century.

Microfilm $2.05; Xerox $7.20. 154 pages.

HISTORY, MODERN

MILITARY OPERATIONS IN MISSOURI AND ARKANSAS, 1861-1865

(L. C. Card No. Mic 58-5265)

Thomas Arvin Belser, Jr., Ph.D.
Vanderbilt University, 1958

Supervisors: Professors Herbert Weaver and Henry L. Swint

The Civil War in the trans-Mississippi West has long been neglected by historians, but the battles fought there contributed a significant part to the final outcome of the war itself. The Mississippi River was the vulnerable left flank of the cis-Mississippi Confederacy and in the end it was the seizure of the control of the Mississippi which enabled the Union armies to turn that flank and to bring about the military collapse of the Confederacy. The Mississippi and its navigable tributaries not only provided excellent avenues for a Northern invasion of the Confederacy but also offered the best means of logistical support for any invading armies operating in a region where the steamboat still provided the primary means of transportation. It was inevitable that Northern generals, given the initiative when the Confederate government committed its troops to the defensive in 1861, would attempt to seize the western river system.

In its dedication to the defensive the Confederate government did not seem to realize the potential economic advantages which the trans-Mississippi slave states offered to the South or that control of both banks of the Mississippi was necessary for continued access to western economic resources. Nor did it seem to grasp the strategic advantages afforded by the trans-Mississippi region. Had the South maintained a strong, dangerous army west of the river the Northern turning movement would have been far more difficult, if not impossible. Such an army would have constituted a definite threat to the entire Middle West, and would have necessitated a great Union army to defend that area, utilizing many of the troops which subsequently fought east of the Mississippi.

The Confederate government made little effort to support its trans-Mississippi states, however, and refused to assist the secessionists of Missouri until that state had

"seceded," although strategically Missouri was the key state west of the Mississippi. Also, it adopted the policy of transferring troops from the trans-Mississippi states to the East instead of concentrating them for action west of the river. This had an adverse effect on the pro-Southern population of those states, who felt that their government had abandoned them. Only after the fall of Vicksburg did the Confederate government realize its error, and then it was much too late.

As several contemporary military historians have pointed out, there has never been an adequate, unbiased study of the war west of the Mississippi, yet campaigns in Tennessee, Mississippi, and Georgia cannot be fully understood without knowledge of what transpired in the trans-Mississippi area. Nor has there ever been any attempt to relate the course of the war in the trans-Mississippi to the course of the Civil War as a whole. Written with these facts in mind, this thesis is a study of Union and Confederate military operations in Missouri and Arkansas from the initial struggle for Missouri through the culmination of Price's final campaign in that state. Political events have been treated in so far as they affected military operations, and strategic, administrative, and logistical problems. In preparing this study extensive manuscript materials located in depositories in Washington, D.C., and in Missouri and Arkansas have been used, as have contemporary newspapers and numerous printed primary and secondary sources. Microfilm $9.95; Xerox $32.40. 786 pages.

THE MILITARY AND POLITICAL CAREER OF JUAN ALVAREZ, 1790-1867

(L. C. Card No. Mic 58-3963)

Clyde Gilbert Bushnell, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Carlos E. Castañeda

The life of Juan Alvarez spans the years from the time of the great viceroy, Revilla Gigedo, until the overthrow of the French regime in Mexico, seventy-seven of the most dramatic and tragic years in the history of that revolution-torn land. Because he participated in every major movement that affected the life of his people during that period and because he played a key role as a Division General, Governor of Guerrero, and ultimately as President of the nation, the life of Juan Alvarez has merited a careful study, something which it has not received before, possibly because of the prejudice which he stirred up by his unflinching defense of liberalism.

Those who have termed him "an illiterate, full-blooded Indian" apparently have not known that he spent a number of years in study in Mexico City; nor have they known that his father was from Spain. Alvarez' enemies have painted him as a cruel and selfish man, one to whom culture in any form was repugnant; but evidence does not support this assertion.

In the archives of the Latin American Collection at the University of Texas can be found many of his letters, some attractively written in his own hand, revealing him to be a man of wide interests, high principles, one imbued with a spirit of humility and self-sacrifice.

The author has endeavored to show that Alvarez' refusal to play the sycophant to Agustín Iturbide and to trade his dream of liberty for a place among the henchmen of the Emperor, caused him to be despised by the military clique which ruled Mexico subsequently for more than thirty years. Indeed, it was that same group which accused Alvarez of treason and cowardice during the Mexican War when he was merely following the enigmatic orders of that wily chameleon, Antonio López de Santa Anna.

Alvarez understood and loved the Indians of his native Guerrero. In their defense against the grasping landowners, under the suspicious eyes of a government which did not comprehend the nobility of his aims, he sacrificed his health and fortune. Among these lowly natives of the South he discovered many a promising lad whom he sent away to school. Ignacio Altamirano was one of these boys who received an education at Alvarez' expense, for the Old Liberal realized that only an enlightened citizenry could eventually achieve freedom in the fullest sense. Thus Mexico owes to the discernment of Alvarez one of her brightest lights, the writer, orator, and statesman, Ignacio Altamirano.

Alvarez supported no government, Liberal or Conservative, which deprived Mexicans of their rights, but was ever the staunch defender of any regime operating in the interest of the nation. The dictatorship of Santa Anna came to an end in 1855 when the supporters of Alvarez drove the tyrant from Mexico and placed their chief in the presidential chair, a position which he had not desired and one which he soon resigned when he saw his presence in the Capital was detrimental to the best interests of the nation. His appointment of Benito Juárez as Minister of Justice and the encouragement which he gave him to strike blows at the privileges of the clergy and the military stirred up undying hatred against Juárez and himself.

Before he died, Alvarez, through the influence of the protégé Altamirano, was proclaimed "Benemérito de la Patria," the highest honor Mexico could pay a worthy son, an honor which the author sincerely believes was merited.
Microfilm $4.75; Xerox $16.00. 372 pages.

THE DAWN OF NATIONALISM AND ITS CONSEQUENCES IN NICARAGUA

(L. C. Card No. Mic 58-1651)

Charles Edward Frazier, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Dr. C. E. Castañeda

Unimpeded command of Isthmian canal sites between the Atlantic and Pacific oceans and the elimination of instability in the region nearby have been regarded as a military and economic necessity by the United States. In pursuit of these objectives and to afford protection to nations abroad, the United States began a policy of intervention in 1909 in the domestic politics of Nicaragua, then under General José Santos Zelaya. The chronicly unstable conditions in the country prompted direct military intervention on the part of the Government of the United States three years later. For the next thirteen years, members of the United States Marine Corps and Navy were stationed

in Nicaragua to maintain order and stability under governments upheld, if not completely selected, by Washington. The withdrawal of United States forces in August, 1925, which proved temporary, ended the first phase of intervention and occupation.

The second phase began in October, 1925, when General Emiliano Chamorro secured control of the government by a bloodless golpe de estado. In an effort to uphold the General Treaty of Peace and Amity of 1923, signed in Washington by the Central American Republics under North American direction, the United States Government refused to recognize General Chamorro. Chaos and revolution followed. Colonel Henry L. Stimson was sent as special envoy by President Calvin Coolidge in 1927, in the hope of establishing peace in the strife-torn country. The unsettled conditions made possible the emergence of the controversial Augusto Calderón (César) Sandino as the leader and champion of outraged Nicaraguan nationalism, who became, after May, 1927, the only partisan of the revolutionary Sacasa Constitutionalists to refuse to accept peace under the terms of the Tipitapa Agreements, or Espino Negro as it is generally called in Nicaragua. General Sandino was immediately branded a bandit and a communist by the United States and both of the historical political parties of Nicaragua. But to the uneducated mozo and campesino he was their glorified leader and savior, who would deliver them from Los Yanquis Imperialistas as well as from the leaders of the Conservative and Liberal parties. It is not easy to evaluate Sandino or his movement, but one thing is clear--his chief significance was that he served as a focal point or magnet for all the undoubted dislike, jealousy, and distrust long felt in Latin America for the United States and gave the uneducated masses of Nicaragua a feeling of national importance prevalent to this day.

To understand fully the situation existing in Nicaragua in the late 1920's, one must know the part played earlier by the United States in the affairs of that Central American Republic. The proceedings of the North American Government and Sandino in Nicaragua after May, 1927, cannot be considered as an isolated and sporadic adventure, but must be viewed as a chapter in a continuing story, which can be understood only when seen against the background of earlier chapters in the history of Nicaragua.

President Herbert Hoover and his Secretary of State, Colonel Stimson, initiated a new policy in Nicaragua which was carried to completion when the United States forces were permanently withdrawn in January, 1933. After this, the United States did not actively intervene in Nicaragua. The North American Government maintained troops in the country from 1912 until January, 1933, with the exception of approximately six months in 1925, and on the surface, accomplished nothing. Intervention undertaken to dispose of a dictator, President Zelaya, finally substituted General Anastacio Somoza in the presidential elections of 1936, who assumed the presidency and continued in power during the longest single dictatorship in Nicaraguan history. His Government, nevertheless, consistently enjoyed the recognition and support of the United States.

Microfilm $8.10; Xerox $28.00. 637 pages.

MISSISSIPPI POLITICS IN THE PROGRESSIVE ERA, 1904-1920

(L. C. Card No. Mic 58-5272)

Charles Granville Hamilton, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Harold W. Bradley

The early part of the twentieth century in the United States was marked by a progressive movement which was a continuation of a democratic trend of American life as well as an attempt to solve certain problems of the period by new techniques. The progressive movement in Mississippi was naturally shaped by the environment of the state. The geography which fitted Mississippi for the production of cotton shaped its destiny, and an acute race problem developed from the preponderance of Negroes. War disturbed the patterns and the Bourbons who rode into power with the ending of Reconstruction replaced Jacksonian democracy.

Memories of the past influenced Mississippi politics at the turn of the century. Agrarian resentment against the long rule of conservatives increased, and a new constitution was enacted to ensure continuing conservative control. Popular reaction resulted in the establishment of a direct primary whereby the average white voter could determine who should hold office.

The leadership of the progressive movement in Mississippi consisted of men who shared the faith of their neighbors as well as progressive aspirations. James K. Vardaman, coming from the planter aristocracy, identified himself with the rising middle class and even more with the underprivileged white farmers, and used white supremacy as his major means of stirring up sentiment, while not neglecting techniques and goals which were common to progressives in other states. His election as governor in 1903 and as Senator in 1911, and his support of the winning candidates for governor in 1907, 1911, 1915, and 1919 marked him as the major leader. Theodore G. Bilbo served as state senator, lieutenant governor, and governor during this period, as a capable lieutenant to Vardaman. Governors Edmund F. Noel and Earl Brewer were especially interested in educational and labor reforms.

Progressive legislatures enacted a long list of reforms. An elective judiciary, a pardoning board, and a reformatory were added, along with the initiative and referendum, a state highway commission, and a state tax commission. Laws regulating corporations, especially railroads and banks, and setting wages, hours, and safety conditions for labor improved the status of many workers. Humanitarian zeal was manifested in prohibition statutes and in increased public hospital facilities.

The overwhelming legislative support for most of these measures showed the influence of public opinion in the state. Progressive leaders channeled a current which they did not create, and, in spite of local prejudices, their measures were part of the national progressive movement. The national mood symbolized by William Jennings Bryan and Woodrow Wilson had its influence in Mississippi, and agrarian discontent expressed itself by electing legislators and governors interested in reform.

The power of the progressives declined after 1918, even though the three succeeding governors were elected as progressives and a few progressive proposals became

law under them. The postwar disillusionment, the reaction against reform, and the return to normalcy which characterized the national scene in the 1920's also marked Mississippi. The failure of progressives to fortify their positions enabled conservatives to eliminate much that progressives had created.

The legislation of the progressive period in Mississippi was comparable to that of other southern states, and progressive leaders in Mississippi resembled in word and deed some of their colorful contemporaries in the South. Although the Mississippi environment resulted in sharp divergencies from achievements of progressive movements in some other states, Mississippi progressives succeeded in writing on the statute books legislation in a considerable degree parallel to that of progressives in other states, with some of the same procedures, problems, and results. Microfilm $4.90; Xerox $16.40. 382 pages.

THE STATE DELEGATIONS IN THE CONGRESS OF THE UNITED STATES, 1789 - 1801 (VOLUMES I AND II)

(L. C. Card No. Mic 58-3980)

Billy Bob Lighfoot, Ph.D.
The University of Texas, 1958

Supervisor: Professor Fulmer Mood

This dissertation is an historical discussion of the three hundred and sixty-nine persons who as senators, representatives, and delegates served in the American congresses during the administrations of Washington and Adams. The dissertation offers biographical sketches of these congressmen, who, collectively considered, stand forth in this period of American history as the largest single segment in the political elite. Each sketch presents data concerning the age, occupation, residence, personal movements, military experience, political experience before election, and political experience after retirement from the congress of each member of that body. The social and economic backgrounds of each member in his own state are given in detail.

The main body of the dissertation consists of eighteen chapters, one chapter for each of the states in the union, one chapter for the representatives of the District of Maine, and one chapter for the delegates of the territories. The discussion of the historical data on a state-by-state basis reveals the particular characteristics of each delegation in high relief, and each delegation is seen to reflect the particular circumstances and conditions of the state that sends it to Congress.

A subordinate contribution of the dissertation is a body of organized information concerning the statutory basis devised in each state for the election of their congressmen. The study shows, what it is thought no existing monograph publication shows, a surprising variety of experiments by state legislatures in enacting laws to provide for the election of members of the congress.

The materials presented in the dissertation furnish an introduction to the politics of the many congressional districts within the several states and to the ebb and flow of political opinion within the legislatures of the sixteen states and the electorate of the two territories.

The dissertation illustrates, with an abundance of examples, the proposition that the federal Congress during the years 1789-1801 was the forum for representatives sent from the many localities which make up the United States, and offers a tested and uniform methodology by which historical studies of the personnel of subsequent congresses may be conducted by students in the future.

Microfilm $16.30; Xerox $54.80. 1296 pages.

THE SENATORIAL CAREER OF SHELBY MOORE CULLOM

(L. C. Card No. Mic 58-5467)

James Warren Neilson, Ph.D.
University of Illinois, 1958

Shelby Cullom was born in Kentucky in 1829 and was descended from an old Maryland family. He was taken to Tazewell County, Illinois, the following year, and grew to manhood on a prairie farm. Educated in the common schools and in the Rock River Seminary at Mount Morris, he studied law in Springfield and gained admission to the bar in 1855. The same year he entered upon his political career.

Cullom served in the Illinois legislature and was Speaker of the House when the Civil war opened. Avoiding a military career, he won a seat in Congress in 1864 and served three terms. There he showed himself clearly in the camp of the radical Republicans, advocating the impeachment of Andrew Johnson and calling for a stern reconstruction of the South. Troubles within the Republican party in his district cost him renomination in 1870.

For two years the former Congressman engaged in banking as an executive of the State National Bank of Springfield, but in 1872 he sought and obtained election to the state legislature. Again he was elected Speaker of the House. Securing reelection in 1874 but losing the speakership to a coalition of Democrats and Independents, he built up a following in the party sufficient to win the gubernatorial nomination of 1876.

Winning the close contest in November of that year and gaining an easy reelection in 1880, Cullom made a fair record as an administrator. He liquidated the state debt, reorganized the militia, and guided the regulation of utilities by the Railroad and Warehouse Commission.

In January, 1883, Cullom left Illinois to assume a seat in the United States Senate, which he was to hold for thirty years. As a freshman Senator he chairmanned the select Committee on Interstate Commerce and sponsored the Interstate Commerce Act of 1887, one of the most important pieces of legislation ever to emerge from Congress. Thereafter, he guided legislation on interstate commerce, until 1901, when he resigned the chairmanship of his committee to accept that of the Committee on Foreign Relations. He held the latter post until his retirement in 1913 --a tenure of this chairmanship longer than that enjoyed by any other Senator in American history.

He was a consummate politician who demonstrated a remarkable ability to gain and hold office. Cullom won an easy reelection in 1889; emerged triumphant from a contest in 1895, which was never greatly in doubt; and gained victory in 1901 after a bitter fight with his former supporter, John Riley Tanner. His last successful election,

that of 1907, followed a decisive victory over former Governor Richard Yates in the preferential primary election of 1906.

In the end, however, Cullom's decision to follow the dictates of his conscience during the trial of his colleague, Senator Lorimer, led to defeat in 1912. Lorimer was tried by the Senate on the charges of gaining election through corruption and bribery, and when the results of an investigation proved to be inconclusive, Cullom chose to stand by his colleage rather than bow to popular, anti-Lorimer feeling. Thus it was that in the primary contest of 1912 the eighty-two year old Cullom met defeat at the hands of Lawrence Y. Sherman, then running on a much ill deserved reputation as a progressive.

Cullom left the Senate in March, 1913, and was named a member of the commission to construct the Lincoln Memorial in Washington. Surviving less than a year, he died January 28, 1914.

Never one of the party leaders, he lacked both the personal characteristics and the training requisite for greatness. Yet he sponsored some of the most important legislation ever enacted into law, and if "the man who looked like Lincoln" failed to secure the Presidency, he nonetheless played a significant role in the governance of his country. Microfilm $6.65; Xerox $22.40. 522 pages.

METTERNICH'S DIPLOMACY AT ITS ZENITH: AUSTRIA AND THE CONGRESSES OF TROPPAU, LAIBACH, AND VERONA

(L. C. Card No. Mic 58-5086)

Paul Walter Schroeder, Ph.D.
The University of Texas, 1958

Supervisor: Dr. R. John Rath

This study, based primarily on unpublished materials from the Haus- Hof- und Staatsarchiv in Vienna, is a survey and interpretation of Metternich's diplomacy in the years 1820-1822. During this period it fell to Metternich to defend the internal security and international position of power secured by Austria at the Congress of Vienna and consolidated in succeeding years against the impact of widespread revolutions in Europe.

The first revolution--the one in Spain--failed to shake Austria's control of her sphere in Central Europe. The revolution in Naples, however, seriously menaced Austrian hegemony in Italy. Metternich determined, therefore, that the constitutional regime at Naples, despite its relative moderation and pacific foreign policy, must be overthrown by Austrian armed force, absolute monarchy restored, and an Austrian army of occupation kept in Naples. Because he needed moral support from the powers, however, he reluctantly agreed to the Russian demand for a European Congress on the Neapolitan question.

At the Congress of Troppau Metternich succeeded, not only in defeating the Russian ideas for peaceful intervention and a moderate constitution at Naples, but also in converting Tsar Alexander to thoroughly conservative views, thereby making Russia a powerful supporter of Austria's policies. Metternich's acceptance of the Russian general intervention principle, however, alienated England, formerly Austria's closest ally.

With Russia's support, Metternich guided the Congress of Laibach into endorsing his proposals for intervention and reconstruction at Naples. Even the outbreak of revolutions in Piedmont and the Danubian principalities failed to spoil Metternich's plans. He persuaded Alexander to support Austria in overthrowing the Piedmontese revolt and to repudiate the revolutions in the Balkans and in Greece, allowing Turkey to stamp them out.

Although Austria's action produced bad results in Naples, where the overthrow of the revolution was followed by misrule and administrative chaos, while the Austrian occupation brought crushing financial burdens and a huge debt to the Neapolitans, the Austrian interventions in Italy accomplished Metternich's purpose of preserving Austrian hegemony there. Metternich was equally successful in dealing with the Russo-Turk crisis of 1821-1822. By exploiting Alexander's desire for peace and alliance unity and his fear of widespread revolution in Europe, Metternich helped avert a war which would have endangered European repose.

Alexander's determination to intervene in Spain, however, forced Metternich to take up the Spanish question at the Congress of Verona. Although compelled to abandon his original policy of ignoring the Spanish revolution, Metternich succeeded at the Congress in uniting the four continental powers in a policy of jointly breaking diplomatic relations with Spain. After the Congress, however, Metternich's diplomacy failed him. He could neither prevent nor control the French armed intervention in Spain, while England, whose policy Metternich had again repudiated at Verona, made a final break with the European Concert.

The writer concludes that in this period Metternich was not, as Srbik and others have portrayed him, a constructive European statesman concerned with fundamental problems of state and society, but rather a repressive Austrian diplomat mainly concerned with preserving Austrian security and power by restraining all political change and preserving the status quo everywhere. Brilliant as a diplomat, he was no real statesman, because the very qualities which distinguished his diplomacy--keen vision, cogent analysis, fertility in expedients, farsightedness, flexibility, and firmness of purpose--were lacking when he dealt with fundamental problems of state. As a statesman, he was characterized instead by blindness to reality, superficial analysis, sterility of expedients, shortsightedness, dogmatism, and failure of will.

Microfilm $5.40; Xerox $19.20. 422 pages.

PARTICIPATION OF OLDER MEMBERS IN 4-H CLUBS IN SELECTED COUNTIES IN SOUTH DAKOTA

(L. C. Card No. Mic 58-5359)

Mary Frances Lyle, Ph.D.
The University of Wisconsin, 1958

Supervisors: Julia I. Dalrymple and
Walter T. Bjoraker

The purpose of this study was to determine whether certain factors associated with the local 4-H Club and the county 4-H organization influenced tenure of membership in local 4-H Clubs in South Dakota. The objectives were: to gather specific information about the characteristics of those clubs to which members of the sample belonged in nine selected counties in South Dakota; to study the amount and type of participation of the dropouts and reenrollees in their clubs and to determine relationships between tenure of membership in 4-H Clubs of dropouts and reenrollees and three factors--characteristics of programs, amount of participation and type of participation.

All comparisons were made between the mean scores of dropouts and reenrollees in four different groups of boys and girls divided according to years of club experience. Student's "t" was used as a test of significance for the five hypotheses, stated in null form. These were: (1) There are no differences between the mean scores of the characteristics of 4-H Club programs in those clubs of dropouts and reenrollees. (2) There are no differences between the mean scores of the number of activities in which dropouts and reenrollees participate in their 4-H Clubs. (3) There are no differences between the mean participation scores of the planning and execution of the programs within the local club. (4) There are no differences between the mean participation scores on the planning and execution of the county 4-H program of dropouts and reenrollees. (5) There are no differences between the mean scores of dropouts' and reenrollees' leadership responsibilities in the 4-H Club and in the county 4-H organization.

The results indicate that it was necessary to reject the hypotheses for the majority of the groups studied. For the most part significant differences between the mean scores of dropouts and reenrollees were found for boys and girls in the study in characteristics of programs and members' awareness of those characteristics, participation in activities of the club, participation in the planning and execution of the local and county program and in leadership responsibilities.

The conclusions reached indicate that:

1. Boys and girls continue to belong to those 4-H Clubs that provide a variety of activities of which the members are aware at the regular meeting of the club.
2. Boys and girls continue to belong to those 4-H Clubs that have some type of club event in addition to the regular meetings of the club.
3. Boys and girls continue to belong to those 4-H Clubs that perform certain activities within the community or as a part of the county 4-H organization.
4. Boys and girls continue to belong to those 4-H Clubs that provide opportunities for member participation in such activities as demonstrations, judging, recreation and the like at the regular meetings.
5. Boys and girls continue to belong to those 4-H Clubs where members have something to do with the planning and execution of the program within the local club.
6. Boys and girls continue to belong to those 4-H Clubs where members know something about the county 4-H organization and have certain responsibilities in the planning and execution of the county program.
7. Boys and girls continue to belong to those clubs where members have some leadership responsibilities, not only in the local clubs, but also in the county organization.

Microfilm $2.00; Xerox $6.60. 139 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A MODEL AND METHOD FOR CONTENT ANALYSIS; IMPLEMENTATION IN A STUDY OF MAGAZINE COVERS

(L. C. Card No. Mic 58-5390)

Doris Wilson Barr, Ph.D.
University of Illinois, 1958

The purpose of this study was to present a concrete model for mass media content and to implement a method for analysis which this model suggests.

Three social lines compose the framework of the model: Individuals, their ideologies, norms and drive and situational states; Events, natural and mediated, and Communications Agencies, formal and informal. The product of the three lines is the Specific Event, here a magazine cover. Composing the covers are conceptual factors or elements, each a non-random product with its own cultural history. Almost 100 of these factors ranging from age to truth composed the Analytical Material; also, the 697 covers were divided by traditional Magazine Classifications. Sharing of factoral categories showed that classifications could be grouped into two principal configurations.

Because males dominated the covers numerically and the Male Adventure covers formed a nucleus classification of a principal configuration, male role was studied by analyzing pictorial and verbal conditioners and cover problem solutions. The conclusion characterized the male as a white hunter-adventurer-scientist-king.

A dichotomy was identified by studying factoral conditioners attached to the female so women characters are divided almost equally in number between the maritally oriented and sex-glamorous types. Entertainers emerge as the ideal female type.

Plural messages differing from straightforward cover stories were identified by using all the given factoral cues and found, in the case of male-oriented covers, to be highly suggestive of punishment of the female, who is frequently symbolized as a dangerous animal.

Sex was the factor most associated with insecurity, which outnumbers the factor of security. The collection also was found greatly influenced by western areas of the U.S. and to employ violence as the most efficient means of resolving conflict.

The conclusion is that the covers represent a search for individual freedom but are highly suggestive of concepts antithetical to such freedom.

Microfilm $5.20; Xerox $18.60. 407 pages.

SELF-REGULATION IN ADVERTISING

(L. C. Card No. Mic 58-5504)

Willard Linn Thompson, Ph.D.
University of Illinois, 1958

For more than half a century, persons in the field of advertising have, to greater or lesser degree, concerned themselves with the need for self-regulation, particularly with respect to truth and good taste in the advertising message. This study is an attempt to document their efforts, with special attention to the period from 1910 to the present time.

The study attempts to relate these efforts at self-regulation to the periods in which they occurred, with particular attention to the forces which may have been responsible for them. These forces include: (1) the critics of advertising; (2) the organized consumers; (3) the threat of governmental regulation; and (4) increased awareness on the part of leaders in advertising of their responsibilities. Chapters 2 through 4 are given over to an analysis of these things.

In Chapters 5 through 10, the efforts of various elements within the advertising industry to achieve more effective forms of self-regulation are examined. Included here are the efforts of the Associated Advertising Clubs of the World, the Advertising Federation of America, the Better Business Bureaus, the American Association of Advertising Agencies, the Association of National Advertisers, the radio and television industry, the newspaper industry, periodical publishers, the Proprietary Association, the Outdoor Advertising Association, distilled spirits industry, motion picture industry, the Toilet Goods Association, and the accident and health insurance companies.

Chapter 11 examines proposals for more effective self-regulation of advertising, as offered by 116 leaders in the advertising agency field. Each of these rejected any thought of added governmental regulation, while suggesting that the answer to the problem lies in some form of education either for the advertiser or the consumer.

Throughout the study there appears to be a direct relationship between the pressures faced by the advertising industry and the industry's interest in self-regulation. All too frequently what efforts at self-regulation that have taken place have been in the form of codes or standards of practice, with little provision for enforcement. There have, of course, been exceptions to this, particularly in the radio and television, the proprietary and the distilled spirits industries. However, these are industries which are subjected to the greatest pressures from agencies from without.

While important advances have been made in the general level of advertising performance since the halycon days of the late nineteenth century, there remains a need for more effective measures of self-regulation if the industry is to avoid further regulation at the hands of the government.

Two important factors are seen as complicating the problem. One of these is the very nature of the advertising process - it is a competitive arm of business and as such is designed to produce results. In the hurly-burly of the competitive struggle, good judgment is frequently lost. Second of the complicating factors is the breadth of the advertising industry and its very complexity. Actually, as is pointed out, it isn't really an industry at all, but a vast conglomerate of persons and organizations lacking in any central core.

In the final chapter the author proposes a solution based primarily on more effective forms of education.

Microfilm $5.50; Xerox $19.40. 430 pages.

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LANGUAGE AND LITERATURE, GENERAL

SIR WALTER SCOTT: AN AMATEUR

(L. C. Card No. Mic 58-3970)

Richard Aubrey French, Ph.D.
The University of Texas, 1958

Supervisor: Willis W. Pratt

Sir Walter Scott was an amateur (one who cultivates a particular pursuit, study, or science, from taste, without pursuing it professionally) in almost all categories of knowledge. A study of the primary sources available reveals the surprising number of twenty-four different divisions of interests in which Scott demonstrated he was an amateur. There are three categories in which one might expect him to be an amateur but in which he showed no interest: science, philosophy, and business.

Scott's interest in sixteen of the total twenty-four categories is presented in this work. Listed alphabetically, Scott's sixteen interests discussed are Abbotsford, architecture, aristocracy, drama, editing, education, history, law, linguistics, literary contemporaries, literature of his British predecessors, military, music, painting, politics, and religion.

Eight of Scott's interests are not discussed in this study because they are either (1) difficult to separate from those presented: (2) not of sufficient importance to require separate study: (3) summarized by either Scott or John Gibson Lockhart: (4) sufficiently treated by other students of Sir Walter. These interests are criticism, historical objects, humanitarianism, medievalism, nationalism, personal acquaintance sources, sculpture, and the supernatural.

In the numerous books and articles about Sir Walter Scott there is none devoted entirely to the subject of Scott as an amateur. This study attempts to make some small progress in rectifying that need. It states that no really cogent reasons can be given for Scott's lack of interest in science, philosophy, and business. The conclusion is that further research should be devoted by future scholars to the question of Scott's interest in nationalism and aristocracy. It is usually assumed that the greatest interest of Sir Walter was Abbotsford; this study disagrees with the generally accepted thesis and insists his chief interest was aristocarcy. In the discussion of the sixteen interests presented, it is definitely proved that Sir Walter Scott was an amateur in each.

Microfilm $6.30; Xerox $22.20. 495 pages.

THE STORY OF DIDO AND AENEAS IN THE MIDDLE AGES

(L. C. Card No. Mic 58-3943)

Louis Brewer Hall, Ph.D.
University of Oregon, 1958

Adviser: John C. Sherwood

During the Middle Ages the story of the love affair between Dido and Aeneas was preserved in three major traditions. Out of an analysis of the Aeneid, directly, an allegorical tradition developed in which tradition Dido was interpreted as a symbol of lust, Aeneas the mind of man. This interpretation had its beginning with Fabius Fulgentius, in the fifth century, and was continued by Bernard Silvestris in the twelfth. At the same time John of Salisbury, proceeding independently, interpreted Dido as the imprudent ruler led astray by a seductive stranger. This method of analysis continued to be influential throughout the Middle Ages, and the results of it can be observed in Dante's Commedia as well as the works of Petrarch and Boccaccio.

The tradition of the story which was to prove more generally influential was one which grew out of the seventh letter of Ovid's Heroides, in which Dido is portrayed as the lover deserted but faithful even unto death. Between the time of Ovid and Vergil and approximately the twelfth century the story of Dido and Aeneas was preserved in medieval schools, especially in the curricula of rhetoric and grammar. The schoolboy practiced his Latin by freely adapting the story for rhetorical exercises. Examples of some of these rhetorical exercises have been preserved, but one of them, the exempla, had a special history. Exempla were collected and simplified into lists, and the name of Dido was preserved in conjunction with that of many women deserted by their lovers: Penelope, Ariadne, Medea, Thisbe, and others. These lists appeared in various works from the fourth century on, in French, English and Latin, and while with most poets the list is little more than a rhetorical amplificatio, what a great poet is able to do with it can be observed in Chaucer's use of the list in the "introduction to the Man of Law's Tale."

The story of Dido and Aeneas was told as part of the redactions of the Aeneid, the earliest of which, the anonymous Excidium Troiae, is dated in the ninth century. After the twelfth century redactions were more frequent, and the French Roman d'Eneas was followed by Simon Aurea Capra's Ilias Latina. Chaucer utilized the story at some length in The House of Fame and the Legend of Good Women.

The third major tradition had its source in the medieval chronicles. These works were not concerned with the love story of Dido and Aeneas but only with Dido and Aeneas as they separately founded Carthage and Italy. From Livy's Ab Urbe Condita came the history of Aeneas, and from the Epitome Historiae Philippicae of Justinus came the history of Dido. In later chronicles Dido was portrayed

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as a widow who took her own life to preserve a vow of chastity made to her husband, and because of the authority of the chronicles a tradition arose that Vergil "slandered" Dido when he converted her into a rejected lover of Aeneas. This tradition was repeated in the works of Petrarch and Boccaccio who explained Vergil's use of the slander by repeating the allegorical explanation of the Aeneid.

The last redaction of the Middle Ages was that of Caxton's Eneydos, and while a translation from French, the events of his story are closer to those of the Aeneid, than the redactions of the twelfth century, especially in his employment of the Roman gods for causal motivation. Gavin Douglas, however, opposed the freedom with which Caxton told Vergil's story, and Douglas' translation of the Aeneid in Scottish is an early manifestation of the Renaissance. However, Douglas is still medieval in his desire to perpetuate the allegorical interpretation of the Aeneid, and thus as a figure who stands between the Middle Ages and the Renaissance, marks the end of the Dido and Aeneas story for the medieval reader.

Microfilm $3.00; Xerox $10.20. 230 pages.

JOSEPH ADDISON TURNER: A STUDY IN THE CULTURE OF ANTE-BELLUM MIDDLE GEORGIA

(L. C. Card No. Mic 58-5274)

Lawrence Huff, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Randall Stewart

The purpose of this research is to examine the life of Joseph Addison Turner (1826-68) and to show his connections with and contributions to the development of culture in ante-bellum Middle Georgia. The basic sources of information used include the William Turner Papers in the possession of Mrs. Leila Turner Griffith, Eatonton, Georgia; Joseph Addison Turner's manuscript Journal, consisting of autobiographical entries and copies of numerous letters; contemporary magazines, newspapers, and books; Turner's various publications and contributions to periodicals; and public records in the Putnam County, Georgia, Courthouse, the Georgia State Library, and the Georgia Department of Archives and History.

The thesis contains nine chapters and follows a chronological organization. Chapter I discusses Turner's ancestry and childhood, including an account of a five-year illness which left him permanently lame. Chapter II develops his life from 1838 through 1845: attendance at Phoenix Academy, a religious experience in 1839, membership in two clubs--the Mouseowlry Court and the Union Debating Society--pursuit of a course of study while serving as overseer of his father's plantation in 1843 and 1844, a love affair with Antoinette Russell, and a brief stay at Emory College. Chapter III reviews the history of belles-lettres in Georgia before the eighteen hundred and forties and describes Turner's initial efforts as a writer--Kemble's Poems (1847), a collection of juvenile verse, and Turner's Monthly (1848), the first of his several literary magazines. Chapters IV and V cover the periods from 1850 to 1855 and from 1855 to 1860 respectively. Among the topics discussed are his practice of law in Eatonton, his marriage to Louisa Dennis (November 28, 1850), his agricultural interests, the publication of The Hasty Plate of Soup (1852) and of The Times and the Tomahawk (1853), his editorship of the Independent Press (1854-55), his attacks upon the Know-Nothings (1855), his defense of Joseph Ashfield, Jr., (1856), the publication of The Cotton Planter's Manual (1857) and of The Discovery of Sir John Franklin, and Other Poems (1858), and his election to the Georgia Senate (1859).

The four remaining chapters deal with his life from 1860 to his death on February 29, 1868. Chapter VI is devoted to his editorship of the Plantation: A Southern Quarterly Journal and his contributions thereto: articles in support of slavery, fugitive poems, tales, critical essays, a five-act farce entitled Julius Sneezer, and a series of thirty-seven sketches called The Old Farmhouse of My Uncle Simon. Chapter VII describes his activities during the Civil War, with emphasis upon the establishment of the Countryman, his employment of Joel Chandler Harris, and the Yankee raid upon his home during Sherman's March to the Sea. Chapter VIII is an analysis of the Countryman, its format, purpose, circulation, and contents, stress again being placed upon his own contributions--a series of letters in the Jack Downing tradition signed "Sally Poke," three acts of a play in blank verse dealing with the treason of Benedict Arnold, and a long poem entitled The Old Plantation. Chapter IX brings the study to a close with a consideration of his last publications and his views on reconstruction.

As a creative writer Turner possessed serious deficiencies--imitativeness, harmful versatility, lack of competent criticism, and perhaps, insufficient talent. But as an editor he exerted a significant influence upon the cultural life of Middle Georgia. Moreover, he taught a sound critical theory which bore fruit in his disciple Joel Chandler Harris. Indeed, the latter's achievement went far towards fulfilling Turner's desire for a distinctively Southern literature. Microfilm $4.30; Xerox $14.60. 336 pages.

THE RHETORICAL STRUCTURE OF THE ENGLISH SERMON IN THE SIXTEENTH CENTURY

(L. C. Card No. Mic 58-5495)

Wilma Sherwin, Ph.D.
University of Illinois, 1958

It is the purpose of this dissertation to point out the literary characteristics of the sixteenth century sermon showing its special relationships to the rhetorical practices of that time. Others have dealt with phases of the sixteenth century sermon, but none has dealt with it in its necessary rhetorical background.

Prerequisite to understanding the literary characteristics of the sermon, some facts about the school system of that day and its emphasis upon rhetorical training are necessary.

Writers of homiletics textbooks, Hyperius, Hemminge, Wright, and Perkins, have simply used the rhetorical apparatus which was common then and have adapted it to the precher's use. They make such statements as, "I do not forge new precepts, but do applie the common rules of Logitians and Rhetoritians...."

The five parts of rhetoric are basically the same for preaching, and the "dispositio" or five parts of the oration are the same for the sermons. The main difference between oratory and preaching is that in inventio the oration deals with secular topics, but the sermon is concerned with Scripture. Neither is the preacher to use the pronunciatio of the orator, but should follow the best examples of other preachers.

The five parts of the sermon are: exordium, division, confirmation, confutation, and conclusion, and are utilized by practically all preachers in this period. Many of them mention some of these terms. Lancelot Andrewes, especially noted for his clear indication of division, often numbers the parts I, II, III.

Some who have written about the Elizabethan sermon approached it with preconceived ideas. Generally speaking, they classified Anglican sermons as being florid and Puritan sermons as plain. Some Anglican preachers were plain in style. Hugh Latimer pointed out that since Jesus Christ used a common manner of teaching, Godly preachers should do likewise. A contemporary praised William Fulke for his "plaine dealing" with the Scriptures. Jewel ridiculed people who were using too much ornamentation in their writing.

In fact, most of the Anglican preachers are straightforward and plain without consciously trying to be ornate. Perhaps one reason for misunderstanding this matter is that many do not realize that preachers used figures of construction in order to make their meanings clear or to drive home their points. Although they used figures, they were not trying to be "florid". Foxe, Drant, and Hooker used figures of construction.

Only a small group of those studied herein were consciously trying to be ornate. These are Playfere, who used medieval unnatural natural history, balanced phrases, mythological figures; Andrewes, who used short choppy sentences, Greek and Latin quotations for effect, wordplay; and Smith, who loved to pile one simile upon another.

One reason why many preachers in the latter half of the sixteenth century were so plain-spoken is that they had broken from Roman Catholicism and were quite absorbed in exposing its errors. With such a serious matter at hand, they were not in the state of mind to preach ornamented sermons.

Regardless of how plain the sermons may be, the rhetoric of the school system played its part. The fact that a preacher did not choose to ornament his sermons is no proof that he did not know how to do so, for rhetorical training also gave preachers the knowledge of how to devise figures of construction.

Rhetorical training is obvious in sermon construction. Practically every preacher made use of the five parts of the oration and probably would have been at a loss without them; for the sermon is only a special type of the oration, and rhetorical principles were adapted for its construction.

Microfilm $2.35; Xerox $8.20. 180 pages.

A CRITICAL EDITION OF DIARMUID AND GRANIA, BY WILLIAM BUTLER YEATS AND GEORGE MOORE

(L. C. Card No. Mic 58-5089)

Ray Small, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Willis W. Pratt

Diarmuid and Grania is a three-act play drawn from Irish legends of the Fenian cycle. Written in collaboration by William Butler Yeats and George Moore, the play was performed three times at the Gaiety Theatre, Dublin, in 1901. Following these performances, Yeats and Moore quarrelled, and for nearly half a century the text of the drama was generally believed to have been lost. This dissertation makes available a complete text of the play, edited from two authentic typescripts belonging to the library of the University of Texas.

This text, in connection with which the revisions made by Yeats and Moore are shown, is preceded by an account of the collaboration and by a critical analysis of the play. Following the edited text is a chapter concerning the sources Yeats drew upon in preparing the scenario from which he and Moore composed the play. The principal source, Standish O'Grady's translation of The Pursuit of Diarmuid and Grainne, is fully summarized in the next chapter, along with a comparative account of the versions, both Scottish and Irish, of the Diarmuid-Grania legend which Yeats knew. Appended is a glossary explaining the allusions in the play to persons, places, and incidents of Irish mythology.

The story of the collaboration is in itself almost a drama. Brief biographical sketches of Yeats and Moore, extending through the period of their work together, indicate that probably no stranger literary partnership has ever existed. Although the collaboration was beset by violent disagreements, valuable contributions were made by each partner. In general it is hazardous to seek the hands of the writers in the play; yet the chapter demonstrates that Yeats supplied the story, that the construction and dialogue were primarily Moore's work, and that Yeats made the final decisions concerning revisions.

Set in ancient Ireland, the play tells the story of the love triangle involving Finn, leader of the Fianna, a warrior band which defended the country against invaders; Grania, daughter of King Cormac; and Diarmuid, Finn's best friend and greatest warrior. Although she is pledged to marry Finn, Grania elopes with Diarmuid. Her fickle behavior endangers the peace of Ireland by estranging the country's chief defenders. Seven years after the elopement, Diarmuid and Finn again become friends, but soon quarrel over Grania a second time. Diarmuid is killed by a boar, and at the end of the play it is obvious that Grania will marry Finn. Ireland is saved, however, for the king and the leader of the Fianna now present a united front against the impending invasion by the Lochlanders.

Critics who witnessed the performances of the play objected to the mixture of ancient legend and modernized treatment of character and incident, accusing Yeats and Moore of having gone to Irish tradition to find the plot of an average French novel. This criticism is scarcely fair. Certainly the play has a good subject and is well constructed. Both the situation and characters are presented

quickly. The characterization is forceful and is psychologically sound, and the action moves swiftly. Moreover, the play preserves the atmosphere of the legend, even though it alters some of the incidents. As a piece of literature, Diarmuid and Grania does not compare favorably with the lyric poetry of Yeats, but the play provides an interesting chapter in the history of his development, a chapter which should not be ignored by the serious student of Yeats and his work.

Microfilm $4.25; Xerox $14.20. 330 pages.

CHILDREN'S THEATER AND DRAMA IN THE SOVIET UNION (1917-1953)

(L. C. Card No. Mic 58-3250)

Gene Sosin, Ph.D.
Columbia University, 1958

Special theaters for children exist in many of the principal cities of the Soviet Union. Financed and supervised by the regime, these "theaters of the young spectator" are run by adult professional artists who devote their careers to producing plays for children and adolescents between the ages of seven and seventeen. The purpose of children's theater and drama in the USSR is to contribute to the cultural and ideological training of the young Soviet citizen. Like other leisure-time activities for youth, children's theaters belong to an integrated network of so-called "out-of-school institutions" which cooperate with the school in pursuing the aims of Communist education.

When the Soviet regime came to power in November, 1917, all theaters were put under the control of the People's Commissariat of Enlightenment, which set about organizing special theaters for children as part of the program of mass education. The number of theaters gradually increased to seventy-one by 1940. After the war approximately half that number continued to operate, attracting millions of young spectators annually. The influence of the theater extends beyond the auditorium since many plays from the repertoire are published in children's books and magazines and are used by amateur dramatic circles.

The contribution of children's drama to the cultural growth of its audience is seen in the production of prerevolutionary classics and folklore of Russia and the West. In addition, contemporary Russian drama for youth includes scores of original plays by Soviet writers, some of whom are among the most talented in the USSR. Tracing the evolution of the repertoire through the successive stages of Soviet history reveals the role of the drama as an ideological instrument. A striking trend is discernible in the number and character of plays which attempted to mobilize children and guide them along prescribed channels. Before 1925, children's drama, like its adult counterpart, was primarily non-political. The theater flourished in an atmosphere of relative freedom, since the ruling Communist Party was more concerned with the regime's struggle for survival than with the problem of controlling literature and art. During the later twenties, in response to the increased demand for plays appropriate to the goals of the new society, dramas filled with social and political content were presented which stressed the broad ideals of socialism and the struggle of the proletariat against the bourgeoisie at home and abroad. With the advent of the first Five-Year Plan period, from 1928-32, came plays reflecting the drive for industrialization and collectivization. In the middle and late thirties, children's drama concentrated on cultivating in young spectators the newly redefined ethics of Soviet socialism: love of the motherland and its leaders, devotion to teachers and parents, perseverance in school work and intransigence toward the enemies of Communist ideology. The war years saw the glorification of the struggle against the Nazi invader. Under the reimposed vigilance of the Party after 1946, children's drama conformed more closely than ever to the regime's demand to inculcate in children patriotism and collective thought as well as hatred for capitalist life.

In harnessing the great potential, which is drama, to Soviet education, the USSR delivers incalculable power to the machinery geared to produce generations of loyal young citizens. Microfilm $5.05; Xerox $17.00. 393 pages.

LE LAI DE L'OMBRE, BY JEAN RENART

(L. C. Card No. Mic 58-2718)

Patricia Ann Terry, Ph.D.
Columbia University, 1958

Le Lai de l'Ombre, a narrative poem written c. 1222 by Jean Renart, translated for the first time into English verse, with an introduction and notes. The introduction emphasizes the realistic and ironical elements, characteristic of the author's two romances L'Escoufle and Guillaume de Dôle, which persist in the Lai in spite of this poem's more conventional plot. The graceful conversations through which a chatelaine is persuaded to accept a previously unknown chevalier as her ami are analysed in detail to show Renart's superior craftsmanship and the nicety of his psychological observations.

Although lacking the scope of the romances in which Jean Renart animated a variety of milieux, Le Lai de l'Ombre is enriched by descriptive details which provide the poem with a visual dimension. Such care has been taken with the background against which the dialogues take place that the poem may appear as a series of brilliantly colored miniatures, some of them simply decorative while others suggest a whole complex of medieval custom.

Renart's style in general gives an impression of simplicity and precision. He attained a very high degree of flexibility in the use of the rhymed octosyllable, and none of the eccentricities which may be apparent can be considered a result of inattention. The early thirteenth century admired extravagant fantasy and a smooth style derived from Chrétien de Troyes. Renart's preference for verisimilitude and economy of expression seems to have cost him the admiration of his contemporaries. He owes to modern scholars not only survival but success.

The present translation is based on John Orr's edition of the E manuscript (Edinburgh University Press, 1948). Where variant readings have seemed preferable they are indicated in the notes.

Microfilm $2.00; Xerox $4.40. 81 pages.

CONRAD'S USE OF EXTRA-NARRATIVE DEVICES TO EXTEND THEME

(L. C. Card No. Mic 58-5521)

Leonard Eugene Zellar, Ph.D.
University of Illinois, 1958

The object of this study is to examine Conrad's use of extra-narrative devices to extend the themes of his novels and stories. Through symbol, allegory, various devices of characterization, irony, and a highly metaphorical style Conrad gave to personal, individual experience a universal significance. The significances beyond those presented on the narrative level are usually of a moral or psychological order. By isolating and examining the extra-narrative devices and their effect upon the themes, it is possible to indicate previously neglected thematic significances. The study is based upon the assumption that Conrad was a highly conscious artist always intent upon charging his fictions with intense moral and psychological meanings; this assumption is supported in the present study by both Conrad's testimony and practice, with the emphasis on practice.

The method is to examine the work of four periods in Conrad's career in terms of devices associated with setting, atmosphere, character, and style in order to isolate those devices which contribute most to the extra-narrative meaning. The four periods (1895-1898, 1900-1904, 1907-1911, and 1912-1917) are examined for devices peculiar to each period, for the development of devices from one period to another, and for devices which run consistently unchanged through Conrad's whole career. Following the examination of each of the first three periods there is an intense analysis of an individual novel which exemplifies the function of the devices isolated in the previous chapter.

In each of the four periods there are extra-narrative devices which grow out of setting. Jungles become symbols of man's subconscious and preconscious mind and are associated with classical underworlds of myth and literature, with the rivers leading to them parallel to Styx and Acheron. Cities, in turn, become jungles and underworlds. The sea usually stands for life with all of its dangers and challenges to man's moral strength.

Conrad's principal characters are usually types motivated by a dominant idea (which Conrad calls an "illusion"). The illusions which are associated with the characters serve to extend and give direction to the themes. Characters are also presented allegorically, representing Biblical, mythological, and historical figures.

Atmosphere often grows out of setting but is also created by imagery of various types. A typical Conradian tragedy employs marmoreal imagery, which suggests lifelessness, imagery of cold, darkness, and corruption, and imagery ominously suggesting the supernatural. Conrad, further, develops an atmosphere of unreality suggesting the dreamlike character of existence. This air of unreality is created by artificial, highly formalized settings and by metaphorical suggestions of the general tenuousness of experience. Atmosphere, as has been suggested, results largely from a highly metaphorical style. Conrad's prose is often heavily concentrated with suggestive adjectives, adverbs, and verbs.

Since Conrad criticism--especially the criticism prior to World War II--has often overlooked or neglected the extra-narrative devices and the resulting extension of themes, the reading of the work in the light of the presence of these devices leads to new interpretations of individual stories and often to new evaluations. Thus, work which has usually been interpreted and evaluated in terms of political significances is found to have as its theme not simply or chiefly political problems but moral and psychological issues. Later work (Victory, for instance) which has been adversely evaluated because of supposed weaknesses in plot and characterization is found to be rich in moral significances developed through effective symbols and other extra-narrative devices.

The results of the study indicate, then, that Conrad through the effective use of extra-narrative devices extended his themes from their bare romantic and political meanings on the narrative level to rich, meaningful analyses of man's moral nature.

Microfilm $3.15; Xerox $10.80. 242 pages.

LANGUAGE AND LITERATURE, LINGUISTICS

A DESCRIPTIVE SINDHI PHONOLOGY

(L. C. Card No. Mic 58-3958)

John George Bordie, Ph.D.
The University of Texas, 1958

Supervisor: Dr. W. P. Lehmann

Sindhi, spoken by some 4,700,000 speakers in the province of Sind, West Pakistan, has been cursorily studied in the past by investigators only partially trained in linguistic analytic methods. The present dissertation seeks to analyze the phonology utilizing modern techniques.

The language is examined for minimal contrastive sets in order to establish the segmental phonemes--41 consonants, 6 vowels--and the manner of their articulation is described. One series of stops is unique in the Indo-European family: the implovise stops. These stops are shown to be cognate with those stops in Sanskrit which are represented in the Devanagari alphabet by double graphemes. The implosives are produced by a lowering of the larynx during closure of the oral cavity so that a suction is produced resulting in audible implosion on release. These implosives are illustrated with spectrograms showing contrast with explosive stops produced in the same articulatory position.

The suprasegmental phonemes--3 stress, 3 pitch, and 4 juncture--are described and an investigation is made of their usefulness in segmenting the flow of speech into individual morphemes. These preliminary cuts enable three form classes to be distinguished: nouns, verbs, and particles indicating grammatical relationships.

A text, text analysis, and form index are appended.

Microfilm $2.00; Xerox $5.40. 107 pages.

STRUCTURAL ANALYSIS OF OLD ENGLISH METRICS

(L. C. Card No. Mic 58-3977)

Mary Lu Joynes, Ph.D.
The University of Texas, 1958

Supervisor: Dr. A. A. Hill

The underlying principle of the Old Germanic metrical system, which includes the Old English metrical system, has been explained linguistically in terms of stress, pitch, and length of syllables, and musically in terms of measures, rhythmical beats, and rest-beats. While all of these explanations are satisfactory in part, a simpler and more nearly complete explanation is possible in terms of the reconstructable suprasegmental morphemes and morphotactics, phonemes and phonotactics, of the language involved. For the purposes of this study the Old English Beowulf text was chosen.

On the assumption that the order characteristics of any part of a language system change more slowly than the individual elements which make up the system, tentative parallel phonotactic and morphotactic systems, both segmental and suprasegmental, may be set up for Old English and Modern English. These systems are then found to be very similar when compared level by level, confirming the structural principle that between two stages of genetically related language, the explanation which assumes the minimum of change is to be preferred over the explanation which assumes a more extensive change. When compared with the regularities in the metrical system itself, the boundaries of pitch-juncture morphemes coincide with metrical and syntactic boundaries, metrical stress coincides with primary stress, and pitch-peaks and alliteration coincide. The sentence appears to have been the basis for the metrical line at one time, but the sentence might be expanded by the addition of phrases or even enclosed sentences, each with its suprasegmental morphemes, thus producing the long sentences and complex syntax of the Old English period. The hypermetric lines which have long been a source of controversy among metrists may then be explained on the basis of their simple syntax as poetic prose or very prose-like poetry. This explanation agrees with the fact that these hypermetric lines are found most frequently as transitions between episodes, and might be presumed to be less important than the main body of the poem. The extremely short lines, however, are quite complex syntactically, and the segmental material within each suprasegmental morpheme would have been drawn out into an elegaic tempo to fill the regularity of the tempo-pattern established in the more regular lines.

Although scribal practice did not regularly mark the suprasegmental system of Old English, there are indications from the Beowulf manuscript that suprasegmental morphemes operated in Old English very much as they do in Modern English and that certain suprasegmental boundaries coincided with metrical boundaries. The most important of these indications are the point, the accent mark, and word-separation.

When tested on other representative examples of the Old Germanic poetic tradition, the new hypothesis functions as well as it did in connection with Old English Poetry. The same metrical principle will also be found in Modern English nursery rhymes, which are usually considered to be preserved intact from very early times by the conservatism of their audience. Microfilm $2.00; Xerox $6.00. 122 pages.

LANGUAGE AND LITERATURE, MODERN

STEFAN ANDRES AND "DIE ORDNUNG DER WELT"

(L. C. Card No. Mic 58-3091)

Robert Joseph Cahill, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Erich G. Budde

This study, devoted to an intensive analysis of the life and works of Stefan Andres, and based upon a broad, critical investigation of his novels, short stories, dramas, poems, and essays, commences with the salient features of the author's life and traces his personal transition and that of his fictional characters towards a well-coordinated concept of man's tripartite relationship to himself, to the world, and to God, which in essence is "Die Ordnung der Welt."

I have analyzed his youthful impetuosity, the trying period of monastic life, and his lengthy separation in Italy from his beloved homeland as rays which are reflected so dynamically in his literary figures. Andres' innate appreciation of nature, his Christian heritage, and his deep love for antiquity are shown as the added media through which as a modern writer, he attacks realistically and fearlessly the burning issues of the day.

It is through his minor works and their world of little people, depicted under the mantle of humor, fantasy, and guile, that I have shown the early echoes of the stark realism, the microscopic character delineation, and depth of thought so synonymous with the name Andres.

Under the motif "Justice tempered by love," the study pursues the author's development from the individual to the metaphysical order. In the temporarily distorted lives of the painter el Greco; the "frozen" sculptor of Positano; and the so-called Knights of Justice, Andres' faith in mankind's potential ability to align the scales of attrition and retribution is evaluated in detail.

The diabolical effects of real and imagined guilt complexes, found in so many of his narratives, is considered then as the core around which Andres broadens his literary scope far beyond the purely individual and metaphysical problems, moving fully into the social order, where families and entire nations are spotlighted.

The study treats the theme of loneliness and its labyrinth of despair as characteristically encompassing a true cross-section of humanity, struggling to find the way back to order and harmony, and aided immeasurably in the search for higher, more elusive goals by the unseen hand of Providence and the intrinsic Christian way of life, in which the author's characters are so firmly rooted.

As the underlying theme of all his works, I have constantly stressed Andres' primary concern to be with the inner man, and specifically with the questions of religion and mankind's eternal salvation mirrored in the symbolic and universal personages of his expansive literary realm. It is the note of hope and optimism that is shown in retrospect to be their further common denominator.

Andres' avowed mission, namely to reveal the hidden entities of life and the world within mankind, is proven to be perfectly consummated in the purely symbolic and epic breadth of his Tanz durchs Labyrinth and Sintflut trilogy, which together constitute a panorama of existence and reflect a maturity of artistic accomplishment.

Finally, I interpret the full crystallization of Andres'

ideas of man, of nature, of God, and the universe--the epitomy of the Divine Plan--as most succinctly radiated in the provocative figure of the heroic, excommunicated priest of Wir sind Utopia. Impelled by love alone--Andres' panacea for ills of the world--Padre Consalves sacrifices the lives of his fellow-prisoners to uphold his God-given Christian principles. And thus, with Andres, I concur: Though weak and easily misled, we are God's Utopia, as long as we strive valiantly to perfect our own human dignity and nobility of soul.

Microfilm $3.45; Xerox $11.80. 268 pages.

THE DICTION OF THE POETRY OF BYRON

(L. C. Card No. Mic 58-3485)

William Cole Childers, Ph.D.
The University of Florida, 1958

Interest in Byron has been largely biographical rather than critical. While every facet of Byron's life and personality has been examined, there have been few critical analyses of his ability as a poet. Two modern critics, T. S. Eliot and Herbert Read, have commented disparagingly about Byron's poetic performance, especially his use of diction. Both critics stress the ambiguous or the evocative word as a criterion for judging a poet's diction. As a result, they accuse Byron for using a diction that does not accord with their own theories. A truer test of a poet's ability is his power to use imaginatively all words, even the most common or frequently used ones.

Among the most frequently recurring words in Byron's poetry are those that convey feeling. Many writers have commented on the predominance of feeling in Byron's poetry, but there has been no attempt to demonstrate how Byron conveys feeling. What I have done has been, first, to establish the explicit words used to suggest feeling. I have counted the number of times that pleasure and pain appear on an average of at least once in every hundred lines. In addition to the central terms for pleasure and pain, I have also determined the words and word clusters that Byron associates with pleasure and pain though the words in themselves are suggestive of neither.

When Byron began his poetic career, he patterned his diction after the "poetic diction" of the eighteenth century. His use of the words pleasure and pain points up an antithetical cast of mind and reflects an emotionalism characteristic of the age rather than revealing any deeply felt personal experience.

In the second period, Byron continues to use the "poetic diction" of the preceding century; however, his references to pleasure and pain point up an ambivalent rather than an antithetical cast of mind. When he voices his romantic ideals about life, youth, love, friendship, man, fame, freedom together with their word clusters, have pleasant associations. However, when he voices his actual awareness of life, the words have painful associations.

In the third period, Byron discards the "poetic diction" of the first two periods. His language is concrete and specific; however, he chooses words for more than their literal meanings. He chooses words for their associations and emotional overtones. In Childe Harold's Pilgrimage, Cantos III and IV, and Manfred, he charges his words with meanings drawn from other poets' use of words or other words related either in sound, or in sense, or in derivation. Above all, Byron charges his words with meanings drawn from his own personality. His diction points up his attempts to reconcile his dual feelings about life. The use of conflicting terms, such as man and nature and mind and fantasy, reveals his unsuccessful attempt to reconcile the painful disparity between the actual and the ideal.

In the final period, Byron's diction conveys both his romantic and ironic attitude toward life. In the dramas and lyrics, youth, love, fame, freedom, man, together with their work clusters, have pleasant associations when Byron voices his romantic ideals about life; however, when he describes those ideals as they exist, the words have painful associations. In Don Juan, instead of being pained by the disparity between the actual and the ideal, Byron turns to laughter. His highly colloquial diction conveys his ironic attitude toward life, an attitude which springs from the humorous incongruity between Byron's romantic longings and his realization of the world's inability to satisfy his longings. Microfilm $2.75; Xerox $9.40. 209 pages.

THE USE OF EVOLUTIONARY THEORY BY AMERICAN POETS: 1900-1950

(L. C. Card No. Mic 58-5406)

Stewart Charles Dodge, Ph.D.
University of Illinois, 1958

Through an examination of the works of seven major American poets of the first half of the twentieth century, this dissertation showed the continuing use of evolutionary theory, its special significance, and the evidence of its attendant sciences in the poetry of the period. Excellent monographs have already dealt with earlier periods. Frederick William Conner, in Cosmic Optimism (Gainesville: University of Florida Press, 1949), considered the use of evolutionary theory and science by the American poets of the nineteenth century. Lionel Stevenson made a similar study of the nineteenth century English poets in Darwin Among the Poets (Chicago: University of Chicago Press, 1932). In The Heel of Elohim (Norman: University of Oklahoma Press, 1950) Hyatt Howe Waggoner extended earlier investigations by treating the reaction to the general philosophy of science by American poets from 1900 to 1950. This dissertation continued the first two studies and provided a concrete and detailed analysis of a major aspect of science in the poetry of the period treated by waggoner.

The seven specific poets considered--Edwin Arlington Robinson, Robert Frost, T. S. Eliot, Robinson Jeffers, Hart Crane, William Carlos Williams, and Wallace Stevens--have formed coherent points of view on evolution, and their works show a wide variety of approaches and techniques. Generally speaking, their works are complete and a summation of their ideas was therefore possible. These poets differ greatly from the nineteenth century poets in their view of evolution, the status of man, the nature of the universe and the problem of survival. They continue to use a great deal of scientific material in their poetry, and their general outlook has been much affected by evolutionary theory and science.

Microfilm $3.95; Xerox $13.40. 308 pages.

CHARLES WENTWORTH DILKE AS A LITERARY CRITIC

(L. C. Card No. Mic 58-3490)

William Garrett, Ph.D.
The University of Florida, 1958

Admired and respected by practically all who knew him, Charles Wentworth Dilke II enjoyed a reputation for his sound judgment. He was radical in politics, was a devoted family man, and while affiliated with no church, was religious in his way. He had a fine sense of humor, a profound distrust for theory, a firm faith in science, and an optimism characteristic of his day. Because of his importance in three general areas of literary scholarship, Dilke deserves greater recognition than he has received in the past. Although scholars have accorded him just praise in some of these areas, his total contribution to literature has not been fully estimated.

Dilke merits recognition first for his unprecedented establishment of the Athenaeum, the leading literary journal of the Victorian period, on a completely independent basis. By refusing to mix in society, by avoiding embroilment in religious or political controversies, and by stamping out the vicious system of puffery which flourished with English literary journals in the past, Dilke proved for the first time that complete impartiality in book reviewing was possible.

Dilke's second claim to recognition concerns his relations with and influence over his contemporaries. He was well known to nearly all the leading literary figures in both the Romantic and Victorian periods--to Lamb, Hunt, Reynolds, Landor, the Brownings, Dickens, Cunningham, Thackeray, and many others. He was one of the three figures at the center of the Keats circle and enjoyed the brilliant company of the London Magazine coterie, one of whom was Hood, who named Dilke as his best friend. Indirectly, Dilke shed an influence for sound critical judgment over these figures, and his direct influence is manifest in the works of certain Romantic contemporaries, especially in those of William Hazlitt.

Finally, Dilke deserves credit for his acute and incisive literary criticism. Emphasizing facts and discrediting rumors, he settled many disputed questions dealing with the authorship of various letters, pamphlets, and books, especially in the works of Swift and in the Junius letters. He found evidences of duplicity in Pope's letters but defended him from charges relative to other matters. He brought charges against and defended other eighteenth century writers. As a dramatic critic with Romantic tastes and Victorian methods, Dilke showed his versatility as a critic of Renaissance drama, especially in his comprehensive, historical perspective. In his Romantic interests and tastes and his Victorian critical point of view, Dilke mirrored the two ages in which he lived.

Microfilm $2.75; Xerox $9.40. 209 pages.

JOHN MILTON'S TECHNICAL HANDLING OF THE LATIN ELEGY

(L. C. Card No. Mic 58-5441)

Paul Edward Kimmich, O.F.M., Ph.D.
University of Illinois, 1958

Ages which have made a cult of studying Latin have succumbed to the power of the masters of Augustan Rome, and it was this Latin that is called the "classic" Latin. The Renaissance in its turn redoubled its efforts to recapture the power of this Latin, but since it had long since been "dead", the only avenue to acquire it was through books, learned efforts, and the researches of antiquarians

It must be relentlessly emphasized that the Latin of the Renaissance was a school enterprise. The school endeavored to saturate the scholar with Latin so that he could unlock the learning of antiquity; so that Latin could become his ordinary language of daily use (it was the spoken and written language of the university, and international scholarship); so that he could write it; so that he could think in it; in short, it was to become his principal language.

In the process of acquiring a full command of Latin, a set program of authors and of exercises was employed. In poetry, the detailed analysis of Ovid--word, phrase, word order--was minutely insisted upon. Other poets--Vergil, Horace etc. were studied, but Ovid served as the introduction to poetry. Then began the labor of imitation, first in a small, then in an extended way. The normal helps available in the form of books of phrases, commonplace books, lists of epithets, dictionaries etc. were pressed into service.

Another very powerful influence in shaping Milton's Elegies was the Renaissance devotion to rhetoric. The identification of good morals with good literature led the Renaissance schoolmaster uncritically to accept the utility motif as the purpose of literature and persuasion as its means. This conviction led the Renaissance to study style as a discipline and to regard nimbleness in grammar a virtue. Milton's Elegies betray the rhetorical bias.

Milton's Elegies had their roots in his schooling, and coming so early in his career they are especially redolent of the school. The Latin elegiac vocabulary of Milton is notably Ovidian (over 90%), and in diction the classic elegiac flavor is remarkably well-sustained. By every available check, the Miltonic Latin elegy closely parallels the Augustan product, and none gives better proof than Milton's fondness for the closed couplet. In the hexameter Milton carefully follows his models: in the avoidance of monosyllabic endings; in the avoidance of polysyllabic endings; in the complete avoidance of spondees in the fifth foot; the penthemimeral rhyme parallels classic usage; and the abundance of penthemimeral caesuras which one and all are classic elegiac techniques and are fully reproduced by Milton. In the pentameter Milton likewise conforms to classic elegiac models by: avoiding monosyllabic endings; avoiding polysyllabic endings; avoiding elision between the two kola; employing bracketed rhyme in the classic ratio; and in employing mid-rhyme. His indebtedness to his schooling and his meticulous workmanship are evidenced throughout, for Milton's Elegies are an expression of the completeness of his absorption of classic lore and learning as then understood. His learning is extensive,

and he delights in showing it. Milton mastered Latin but was not mastered by it.

Microfilm $6.70; Xerox $23.60. 527 pages.

A HISTORY OF STUDIES OF THE OLD FRENCH WILLIAM CYCLE

(L. C. Card No. Mic 58-5466)

Francis Weldon Nachtmann, Ph.D.
University of Illinois, 1958

The William Cycle, consisting of some two dozen poems, occupies a peculiarly important position in the history of research on the Old French epics. It has been cited, at different periods, as the prime example of the two contradictory theories of their origin and development. Further enhancing its importance was the discovery in 1903 of the Chanson de Guillaume, which has been a leading subject of study ever since its publication.

Since there was historically a William of Toulouse in the ninth century who served Charlemagne and Louis the Pious and who became a saintly monk and was buried at Gellone, the William Cycle was early cited as an example of how the Old French epics could trace their poetic origins back to historical events. Fauriel first popularized this idea, and Jonckbloet developed it extensively in his study of the William Cycle which accompanied his edition of five of the poems in 1854. The cantilène theory, Gaston Paris' refinement upon his predecessors' ideas, was in turn applied by Jeanroy to certain problems of the William Cycle.

Continued study of the related literature has weakened certain important evidence previously cited as bridging the "silent centuries". The Vita Sancti Guilelmi, since the work of Révillout and Pückert, has been considered a twelfth-century composition. The Hague Fragment, perennially re-studied, has failed to yield generally convincing evidence of its early date or even its application to the William Cycle.

When the cantilène theory was challenged by Joseph Bedier in his Les Légendes épiques, he devoted all of Volume I to the William Cycle as the best evidence of the poetic origin of the chansons de geste in the eleventh century and no earlier. His emphasis on the influence of the pilgrimage routes was also based first on evidence related to Saint William of Gellone and the William Cycle epics. Bédier had been strongly influenced towards these ideas by Ph. A. Becker, who for more than half a century remained the chief specialist in the William Cycle.

The controversies revolving about the Chanson de Guillaume have not been resolved, except for agreement concerning its composite character. Duncan McMillan, challenging even its ancestral position, proposes now that it has been dated too early. Nevertheless, the origins of the cycle have generally been sought in this poem and in the four basic epics concerning William: Le Couronnement de Louis, La Prise d'Orange, Le Charroi de Nîmes, and Le Moniage Guillaume. Some earlier form of the Prise is widely considered to have been the nucleus of the cycle. The greatest innovation of recent scholarship is Becker's theory (1939) that the four basic poems were written by the same author.

The Aymeri Group, tracing William's clan to earlier generations, is viewed as a later literary product. The only certain historical evidence for its background is of the twelfth century. Efforts to trace the clan as a whole to an earlier period rely upon the Hague Fragment. The principal studies of the Aymeri poems were produced in the nineteenth century by Demaison, Suchier, and Couraye du Parc.

The Vivien-Rainouart-Foucon Group (the cycle around Aliscans) represents the extension of the clan through later generations and is likewise regarded as a later development. The personage of Vivien is now viewed only as an imitation of Roland.

Recent studies of the William Cycle have reflected the rehabilitation of the cantilène theory, or at least a modified Bédiérisme like that proposed by Italo Siciliano. Siciliano opposes offering any single solution of the origins of the Old French epic.

Microfilm $4.60; Xerox $15.40. 359 pages.

THE ESCAPE MOTIF IN THE WORKS OF ERNEST HEMINGWAY

(L. C. Card No. Mic 58-5093)

Robert Oren Stephens, Ph.D.
The University of Texas, 1958

Supervisor: Philip Graham

The escape motif in the works of Ernest Hemingway is manifested in a three-stage process of rejection, avoidance, and search for new values. The process, as it is shown in the careers of the protagonists, outlines their search for empirical values on both the social and personal levels. Thus, the protagonists reject traditional answers, flee from situations where they previal, and search for new situations where empirical values are respected. Some of the techniques employed in the second and third stages of the escape process include expatriation, primitivism, bohemianism, sports, alcohol and narcotics, sex, spiritual love, religion, fantasy, and art.

As the protagonist goes through the stages of the escape process, he rejects values which he earlier embraced. He begins by rejecting provincial American society in order to live in the cosmopolitan cities of the East. When all traditional society is discredited by the First World War, he lives in the unconventional expatriate society of Europe. When the international bohemians corrupt this select group, he retreats to the bull rings of Spain, then to the wilderness of Africa, in order to separate himself from civilization, and finally to the open sea, in order to separate himself from humanity. He learns during his conflict with the forces of nature, however, that he must make some return to society, for the solitary man, regardless of his personal values, is too weak to exist alone. He effects his return during the Spanish Civil War because he believes that the Spanish Republic will recognize individual values. His experiences during the Second World War and during the postwar period confirm this decision.

The constant parallel between the careers of the protagonists and that of Hemingway himself indicates that escape is valid for the author as well as for his fictional

creations. As an alternate, escape is preferable to combat or surrender in a world of overpowering evil.

Microfilm $4.15; Xerox $14.00. 321 pages.

A CRITICAL EDITION OF SELECTED LYRICS OF WILLIAM BUTLER YEATS

(L. C. Card No. Mic 58-5099)

Thomas Lee Watson, Ph.D.
The University of Texas, 1958

Supervisor: H. H. Ransom

Although the poetry of W. B. Yeats has been treated in many critical studies, no attempt has been made to put a large number of the lyrics against the background of Yeats's prose works. This study is an anthology which attempts to place the text of the poems side by side with the prose as intellectual, historical, and biographical background.

This anthology is divided into two main parts. The Introduction is a critical discussion of Yeats's lyrics. It attempts to develop important facets of Yeats's poetry and to examine the poetry in the light of his changing critical judgments about poetry, his own in particular. In addition, the Introduction presents a general explication of some aspects of the problem of Yeats's developing poetic method and technique and tries to point out a continuum rather than a great difference in his entire poetic career. His attempt to symbolize all levels of experience became a primary concern, and the poetry is the result of this attempt. Therefore, the critical discussion develops Yeats's poetic career from the standpoint of subject matter, symbolism, language, and dramatic structure. Attention is given to Yeats's prose ---letters, literary essays, critical statements---which throw light on his poetic intentions and achievements. The historical, philosophical, and psychological backgrounds for the poetry are taken up in a discussion of A Vision and other antecedent philosophical essays.

The main body of the dissertation consists of selected lyrics with notes and annotations to the text of the poems. For each published volume and for each poem there is a bibliographical headnote setting the poem in a chronological context. There are some one hundred lyrics dating from the very early lyrics of The Wanderings of Oisin of 1889 to the last lyrics of Last Poems, 1936-1939. The selection attempts to establish not only the development of Yeats as a poet but to show the interrelation and the continuity of Yeats's poetry as it enveloped a world of symbols which grow familiar and significant when seen in their varied and protean forms. No similar attempt has been made to study the text of Yeats's poems or his career in a form such as this.

The selections in the anthology have been made as objectively as possible, primarily on the basis of what Yeats said were his intentions in the poetry and with the idea that Yeats's prose statements about his principal ideas are suitable in a study of the intellectual, cultural, and philosophical background of the poems.

Microfilm $5.35; Xerox $19.00. 419 pages.

EVELYN SCOTT: A LITERARY BIOGRAPHY

(L. C. Card No. Mic 58-5281)

Robert Louis Welker, Ph.D.
Vanderbilt University, 1958

Supervisors: Professors Richmond Croom Beatty and G. Neil Bennett

Many critics in the 1920's and 1930's considered Evelyn Scott among the most important women novelists of America. Since then, her work has been given little attention. This study makes the first comprehensive examination of Evelyn Scott's work and suggests her proper position in American literature.

Never before considered in the light of her regional background, Evelyn Scott is now examined in relation to her ancestry and region. As a corollary to this investigation, a cultural history of her birthplace, Clarksville, Tennessee, is reviewed as pertinent to the aesthetics and underlying philosophical tenets of other contemporary artists -- Robert Penn Warren, Caroline Gordon, and those of lesser reputation from the same region. This study reveals that rather than being a rebel against tradition, Evelyn Scott reasserts those basic values upheld by the best of the Southern Renascence writers.

Expressing the philosophical tenets of her regional background, Evelyn Scott's works reveal an original interpretation of cosmic order based on the materials of American life. On a canvas which is in no way limited to one locale, she delivers her interpretation of cosmic order in terms of her myth of the liebestod. Through objective contemplation, her liebestod is a remarkable refocusing of eternal paradoxes and the universal values of the individual examined in the light of the intellectual thought and psychological knowledge of our time. From her myth emerges an original yet ancient version of ultimate reality with its own God and attendant human values sufficient in strength to the needs and greater glory of modern man.

The corpus of contemporary criticism of Evelyn Scott is examined and found lacking in essential comprehension of Evelyn Scott's larger aesthetic and philosophical aims. While recognizing finished technical skill, great magnitude of vision, profundity of insight, and innovating contributions to form as characteristic of her novels, the early critics generally failed to take note of the totality and wholeness of Evelyn Scott's art which becomes apparent when her aesthetic aims and her myth of the liebestod are recognized. Certain critical misconceptions are corrected by interpretative explication and a structural analysis of twelve of her works. Involving a consideration of her technical innovations and strict aesthetic objectives, the study reveals her fiction to have been written on a scale and a level which is unique in American literature.

Few American novelists have matched Evelyn Scott in the scope of her social and historical vision, the balance of her great intellectual and emotional intensity, the success of her experimentations in form and technique, the virtuosity of her range, or in her penetrating insight into those psychic and psychological aspects of character which constitute fate. She combines the tradition of the panoramic novel with the "well-made" novel; at the same time she unites the tradition of the social novel and the art novel in the manner of European masters like Tolstoy, Thackeray, and Mann. Her novels demonstrate methods by which

emotional and intellectual intensity may be properly balanced to create the "post-adolescent" American novel. For her artistry, timelessness of theme, and original contributions to form and technique, Evelyn Scott deserves to be recognized as a major American novelist.

Microfilm $8.30; Xerox 28.60. 655 pages.

LIBRARY SCIENCE

COLLEGE AND UNIVERSITY LIBRARY SURVEYS, 1938-1952

(L. C. Card No. Mic 58-5412)

Ernst Walfred Erickson, Ph.D.
University of Illinois, 1958

Although the college and university library survey conducted by outside experts was a late development in the total survey movement in America, when it once began in 1938 with the survey of the University of Georgia Library, it gained momentum rapidly and a survey technique was quickly developed. In this study an attempt has been made to ascertain what have been the results of the twelve major surveys of this type during the period 1938-1952. Included are the Universities of Florida, Georgia, New Hampshire, Notre Dame, and South Carolina, Alabama Polytechnic Institute, Cornell University, Indiana University, Montana State University, Stanford University, Texas A. and M. College, and Virginia Polytechnic Institute.

Data were collected chiefly through the use of extensive questionnaires, correspondence, journal articles, annual reports of librarians, survey reports, and other special reports. The writer visited five of the libraries personally, spending two days on each campus interviewing the director and other staff members and seeing at first hand the results of the implementation of survey recommendations.

In the case of each recommendation made in all of the survey reports an attempt was made to ascertain the extent to which it had been carried out and within how many years after the survey the accomplishment had taken place. The director of the library was also asked to say whether in his best judgment he thought the carrying out of a recommendation to have been the direct result, the indirect result, or no result of the survey, and whether he agreed or disagreed with the recommendation. In most cases the librarians elaborated upon their answers in the questionnaire giving considerable supplementary information.

Of the approximately 775 recommendations made in the twelve surveys it was found that 531, more than two thirds of the total, were carried out to some degree, 269 completely, 185 to a large degree, and 77 to a small degree. Greatest success was achieved during the first two years following the surveys, when 45.5 per cent of the recommendations carried out in whole or in part were achieved. Librarians agreed with the recommendations in 88.9 per cent of the cases.

Though the writer admits the difficulty of attributing results directly or indirectly to the survey, in the best judgment of the librarians involved 67.4 per cent of the recommendations carried out in whole or in part were said to have been achieved as results of the surveys, slightly more than half of them as direct results.

It was found that in most cases following a survey, library organization was improved, budgets were increased, technical processes were made more efficient, readers' services were bettered, and corresponding improvements were made with varying degrees of success regarding the other essentials of a good college or university library program.

In addition to direct improvements which took place following the surveys, there were salutary by-products which were important. The survey was generally a professional stimulus to the library staff, a library consciousness was developed on the part of the administration and the academic community, the survey and survey report were an educational instrument for the administration and faculty, and the publication of the report itself provided a document useful to the librarian and staff in planning the development of the library and to students of library administration generally.

On the basis of this study it would seem that the college and university library survey as conducted by outside experts is an effective instrument in bringing about results conducive to the growth and development of the surveyed library. Microfilm $5.85; Xerox $7.80. 459 pages.

THE DECLINE OF THE PAPERBOUND NOVEL IN AMERICA, 1890-1910

(L. C. Card No. Mic 58-5432)

Robert Russell Hertel, Ph.D
University of Illinois, 1958

Between 1890 and 1910, the publication of paperbound novels became an unprofitable venture for American publishers who attempted to issue inexpensive fiction for the low-priced book market. The cheap books movement of the 1870's had provided the American public with books of foreign authorship which were not protected by copyright and could be published by more than one firm. Widespread publication of the same novels had so endangered the profits of all elements of the book trade by 1890 that most publishers supported the enactment of the International Copyright Act of 1891. This improved copyright legislation has been regarded as a chief cause for the decline of paperback publishing during the next two decades. The purpose of this study is to show that the existence of many firms issuing paperback fiction series, the publication of large editions and the existence of a large body of uncopyrighted fiction were equally responsible for this decline.

Most publishers provided the low-priced book market

with a fifty-cent or twenty-five cent paperbound edition of new novels issued simultaneously with the higher-priced clothbound edition. these novels were published in series, were distributed as periodicals and were sold in newsdealer, department store and bookstore outlets. In the peak year of 1893, some fifty publishers were competing with each other in the marketing of ninety-four different paperback fiction series. Each series novel was usually published in an edition which varied from 25,000 to 30,000 copies. Despite John W. Lovell's attempt to obtain all the plates and stock of uncopyrighted novels for his huge United States Book Company, he was unsuccessful in limiting the number of paperback competitors, or in preventing the lowering of prices and profits on unprotected novels. The bankruptcies of Lovell's novel trust and of many paperback firms during the 1893 depression flooded the book market with millions of copies of paperback novels which were sold at greatly reduced prices. The large number of competing paperback firms which specialized in large fiction editions was a chief cause for the reduction of price levels and profits. The existence of a large body of uncopyrighted fiction which was published by many competing firms was a contributing factor in the price reduction of most paperback series. As a result of lower profits, paperback publishers used cheaper materials in the manufacture of their novels, and could not keep pace with the progress in bookmaking and book design which was taking place in the publishing industry. After 1896, most book publishers discontinued the unprofitable paperback edition of new novels.

Improved copyright legislation gave protection to the foreign author who could demand and receive better terms from American publishers. Increased costs of literary property impeded the efforts of paperback publishers to obtain novels for their series inexpensively. They resorted to literary piracy, the publication of older uncopyrighted novels and the issue of ephemeral stories from cheap fiction magazines to supply their series with novels. Street & Smith was the only firm which developed a nationwide corps of writers for its magazines and paperback series. Improved copyright legislation was an important contributing factor which prevented paperback firms from publishing popular novels of recognized literary merit.

Most book publishers became convinced that the clothbound reprint edition of their best selling copyrighted novels, published under contract by Grosset & Dunlap several years after the initial appearance of the higher-priced edition, was a more profitable type of inexpensive fiction for the low-priced market than the paperback series. By 1910, only four firms were publishing paperbound novels.

Appendices contain individual histories of paperback firms, samples of reprint agreements, and a bibliographical record of paperback series.

Microfilm $3.60; Xerox $12.20. 280 pages.

A STUDY OF CURRICULUM LABORATORIES IN MIDWESTERN TEACHER-TRAINING INSTITUTIONS

(L. C. Card No. Mic 58-3706)

Donald Sidney Mac Vean, Ed.D.
University of Michigan, 1958

The purposes of this study are: (1) to report the present status of curriculum laboratories in fifteen midwestern teacher-training institutions; (2) to identify and describe the characteristics of these agencies which make them successful or outstanding; and (3) to show the contribution of a curriculum laboratory to a teacher education program.

The colleges and universities included in the study were selected from twenty-six teacher-training institutions in the following states: Illinois, Indiana, Iowa, Michigan, Minnesota, and Wisconsin. The data were collected by means of a questionnaire, correspondence, and visits to each institution.

The purposes of these curriculum laboratories are: (1) to acquaint teachers with curriculum materials; (2) to make teachers more competent in the selection of curriculum materials; (3) to give teachers a practical rather than merely a theoretical knowledge of the tools of learning; and (4) to make teachers more versatile in instructional practice by providing them descriptions of various school programs.

Services of curriculum laboratories, reported ten or more times, are: (1) to assist students in construction of units of work and lesson plans; (2) to collect and organize curriculum materials; (3) to assist in selection and analysis of textbooks and other materials; (4) to advise students about curriculum problems; (5) to give lectures to students about curriculum materials; and (6) to lend curriculum materials.

Nine curriculum laboratories are administrative units of the institutions' libraries, three are separate departments, two are a part of the education department, and one is administered as a part of the laboratory school. Nine curriculum laboratories are limited to one room, three have two rooms, one has three, and two have five.

Professional staff members are employed full-time in six curriculum laboratories and part-time in nine. Also in nine curriculum laboratories students are employed to do clerical and routine work. All but one of the persons in charge of the curriculum laboratories have had training and experience as either librarians or teachers. Six have had training and experience in both fields.

In addition to the usual curriculum materials--course of study, textbooks, units of work, and tests--pamphlets, juvenile encyclopedias, and audio-visual aids are found in some curriculum laboratories. Materials are selected by the librarians and faculty members. Sources used in selecting materials are: (1) textbook publishers' catalogs, (2) Textbooks in Print, (3) education journals, and (4) Education Index.

The classification systems used, in order of frequency, are (1) special classification schemes without a notation, (2) the Dewey decimal classification system, and (3) special classification schemes with a notation.

The card catalogs maintained, in order of frequency, are: (1) shelf list, (2) author catalog, (3) dictionary catalog, (4) subject catalog, (5) publishers' catalog, (6) series catalog, (7) author-title catalog, and (8) a subject analytics catalog for units in courses of study.

Annual budgets for seven curriculum laboratories range from $50.00 to $5,092.00; the median is $1,098.00.

The more important conclusions drawn from this study are:

1. Curriculum materials are most useful when organized as a separate collection.

2. At most of the institutions, the operation of a curriculum laboratory is considered a library function. Other factors being equal, however, the location and administrative relationship of the curriculum laboratory to other departments of the college do not seem to affect its functions or services in any significant way.

3. It seems desirable that the person in charge have training and experience in both education and library work.

4. The classification systems employed, although varying greatly in detail, reveal that there is a preference for a system which will group materials by broad subject.

5. Catalogs maintained are generally inadequate. Their primary weaknesses are that they often fail to reveal (1) what is available on a subject, (2) shelf arrangement, and (3) contents of courses of study.

Microfilm $3.25; Xerox $11.00. 249 pages.

MATHEMATICS

PARTIALLY ORDERED IDEAL PRESERVING GROUPS

(L. C. Card No. Mic 58-3477)

Jan Frederick Andrus, Ph.D.
The University of Florida, 1958

This dissertation is concerned with an ordered algebraic system called a partially ordered ideal preserving group, which is a generalization of the familiar system known as a partially ordered group.

The structure of a non-dualistic partially ordered ideal preserving group (that is, one in which the dual of any proposition concerning the system is not necessarily valid) is completely described with little difficulty. Equivalence relations called weak and strong connectivity are defined which partition a dualistic partially ordered ideal preserving group P into disjoint subsets referred to as weak and strong components, respectively. Left or right translation of a weak component C by an element either completely preserves the ordering of C or completely reverses the ordering of C. The elements of a strong component have the same order preserving and order reversing properties relative to any given weak component. Actually the strong components are cosets of a normal subgroup S_0, which is a partially ordered group under the relativized ordering. When ordered in a very natural manner, the quotient group P/S_0 is a finite dimensional dualistic partially ordered ideal preserving group. It is shown that P is order isomorphic to the ordinal product of S_0 and P/S_0. After the structures of finite dimensional dualistic partially ordered ideal preserving groups are determined, the order structure of P is characterized in terms of S_0. By means of examples it is shown that the algebraic structure of P is not completely determined by S_0 and P/S_0.

Finally, necessary and sufficient conditions that a group can be ordered to form a non-trivial dualistic partially ordered ideal preserving group are given.

Microfilm $2.00; Xerox $3.80. 67 pages.

CONCERNING INTEGRALS

(L. C. Card No. Mic 58-3953)

William David Love Appling, Ph.D.
The University of Texas, 1958

Supervisor: Dr. H. S. Wall

This paper is concerned with a new integral defined by substitution of a suitable nonnegative number for 0 in certain older definitions of integral.

Properties of the integral, such as integration by parts, characteristics of the upper and lower integrals and linearity properties, are derived.

Certain comparisons are made between integrals defined in the above mentioned manner, but in terms of different summation forms.

Finally, the integral is used to discover certain properties of functions and of function pairs.

Microfilm $2.00; Xerox $3.00. 57 pages.

APPROXIMATIONS TO EINSTEIN'S EQUATIONS OF GENERAL RELATIVITY

(L. C. Card No. Mic 58-5393)

Judith Richman Blankfield, Ph.D.
University of Illinois, 1958

It is well known that the Newtonian approximation to Einstein's equations gives solutions of the equations of classical hydrodynamics. An orthogonal metrical tensor used by McVittie led to a solution with the restriction that the momentum-vorticity of the fluid motion (i.e., the curl of the density multiplied by the velocity vector) is zero, and it was suggested that a non-orthogonal metrical tensor would remove that restriction. In the thesis of which this is an abstract, that conjecture is investigated and found to be correct.

In order to achieve an approximation procedure that is clear, dimensionless forms of Einstein's equations are developed and it is shown that there are two fundamental

small parameters, one of which is the ratio of a characteristic velocity to the velocity of light, the other is a parameter proportional to the constant of gravitation. Approximations in terms of these two parameters are applied to the case in which a spatially orthogonal metrical tensor, but with non-zero space-time terms, is used, and it is found that the fluid motion described by the Newtonian approximation in this case has non-vanishing momentum-vorticity components.

It is shown that there is no loss of generality due to using a metric which is spatially orthogonal. It is further shown that it is the form of the functions involved in the metrical tensor used by McVittie as well as its orthogonality which is responsible for the vanishing of the momentum-vorticity, and an orthogonal metrical tensor is displayed which leads to a fluid motion which has a non-zero momentum-vorticity.

An approximation used by Einstein and Infeld which involves an "arbitrary" small parameter is examined in terms of the two parameters described above. It is found that the parameter used by Einstein and Infeld is not so arbitrary as seems to be implied by their statements, and in fact can only be identified with the parameter which is inversely proportional to the speed of light.

Finally, by redefining the energy tensor, solutions of the equations of magneto-hydrodynamics are found. In particular, it is demonstrated how the equations of magneto-hydrodynamics admit a one-dimensional solution in which a gas cloud can be held together by a magnetic field which balances, ultimately, the force of the pressure gradient.

Microfilm $2.00; Xerox $3.00. 56 pages.

AN EVALUATION OF SELECTED ASPECTS OF THE MATHEMATICS PROGRAM AT THE UNIVERSITY OF HOUSTON

(L. C. Card No. Mic 58-5558)

Loren Vincent Corotto, Ph.D.
University of Houston, 1958

The college freshman deficient in mathematical background who desires to enter occupational areas that require mathematics training has created several difficulties for colleges and universities. Deficient students have to be selected out of the entering freshman class, counseled, and placed in mathematics courses in keeping with their mathematical aptitude and achievement. Previous studies have shown that mathematical aptitude tests and mathematical achievement tests are the most effective instruments in differentiating mathematically deficient students from students with adequate mathematics backgrounds. Numerous studies have demonstrated that the best predictor of success in an initial mathematics course is a test of mathematical aptitude or mathematical achievement. The marked and unsystematic variability of standardized test instruments found in different institutions of higher learning has led many writers to emphasize the caution that local evaluations should be made to establish a local validity, since research indicates that variability associated with students (motivation, mathematics background, etc.), sex, courses, content, teaching, and examination methods contributes to success in mathematics courses.

The present study was concerned with exploring the relationships between (1) success in an initial mathematics course and scores on the three scales of the American Council on Education Psychological Examination for College Freshmen and (2) success in an initial mathematics course and scores on the Mathematics Screening Test developed at the University of Houston. In addition, the effects of a purely remedial mathematics course, Mathematics 030, were examined in an attempt to evaluate the usefulness of the course in preparing deficient students for further college level mathematics courses. Various analyses of the data were made in an attempt to evaluate these three problems posed by deficient students.

An examination of the Permanent Record Cards of all freshmen who entered the University of Houston in the fall of 1955 was undertaken during the summer of 1957. Five hundred and twenty-nine students in the population explored were found to have completed an initial course in one of the four mathematics course levels with algebraic content. Complete information on several variables considered important as controls was required for each student included in the study. Samples were composed on the basis of specific mathematics courses taken and on the basis of selected Mathematics Screening Test scores.

The criterion measures used in this study were success in the initial mathematics course (grade of A, B, or C) and a grade point average of "C-" (1.50) or higher in all mathematics courses taken during the two year period from the fall of 1955 to the summer of 1957. Grade point averages were computed on the basis of 4 points for an "A", 3 points for a "B", 2 points for a "C", 1 point for a "D", and no points for an "F".

Nineteen pairs of subjects matched on nine pertinent variables were divided into an experimental and a control group. The experimental group completed Mathematics 030 prior to taking Mathematics 153, while the control group took Mathematics 153 as its initial mathematics course. A chi square analysis of the pass (A, B, and C grades) and fail (D and F grades) distributions yielded a chi square value of +.57 with 1 df. This chi square value is not significant.

Hypothesis 1: The remedial mathematics course, Mathematics 030, does not increase the mathematical skills of students who take this course sufficiently to enable them to compete more successfully in subsequently more difficult mathematics courses than comparable students who do not take the remedial course.

The results of the study confirm the first hypothesis.

A correlational analysis utilizing the biserial correlation technique did not confirm the second hypothesis examined in this study.

Hypothesis 2: The ACE Psychological Examination for College Freshmen does not significantly distinguish between students who make passing marks in their initial mathematics courses (A, B, C) and students who make failing grades in the same initial mathematics courses (D, F).

Hypothesis 2 must be rejected on the basis of the statistical results obtained. However, a closer examination of the relationship between the ACE and success in specific mathematics courses does not yield significant correlations. The total score and the quantitative score on the ACE yielded significant correlations with success in an

initial mathematics course as well as success in a specific mathematics course, Mathematics 030. None of the three ACE scales correlated with success in Mathematics 153 or Mathematics 131 courses. The linguistic scale on the ACE failed to reveal significant correlations with success in the combined distributions of Mathematics 030, 153, and 131 or with success in any specific one of the courses. All biserial correlations were in a positive direction, even though several were insignificant.

The results compiled from the evaluation of the Mathematics Screening Test reveal the most significant relationships noted in the entire study.

Hypothesis 3: The Mathematics Screening Test does not significantly distinguish between the students who pass their initial course in mathematics with grades of "A", "B", or "C" and the students who fail the same initial course with grades of "D" or "F"

The third hypothesis has to be rejected in the light of the significant correlations. Success in an initial mathematics course--153 or 131--was found to correlate with Mathematics Screening Test scores to a very significant degree. The MST did not correlate significantly with success in Mathematics 030 as an initial course. However, when the Mathematics 030 group was restricted to the recommended MST score range (0 - 9), a significant correlation was obtained. A few extreme scores in the upper ranges apparently introduced bias. Chi square comparisons between success and failure with the upper and lower five point MST ranges for Mathematics 030, 153, and 131 produced significant chi square values. A significantly greater number of students with high MST scores pass an initial mathematics course than do students with lower tests scores.

The results of the present study indicate several trends and suggest some tentative conclusions. In summary, the results indicate that these generalizations have some validity.

(1). Students deficient in mathematical background have just as good a chance of passing Mathematics 153 whether or not they take Mathematics 030 preparatory to taking Mathematics 153 and whether or not they take Mathematics 153 as their initial college mathematics course.

(2). A student has a better chance of passing his initial mathematics course when the initial course is Mathematics 030 rather than Mathematics 153, 131, or 154.

(3). It is a more difficult task to predict success in Mathematics 030 as an initial mathematics course than to predict success in Mathematics 153, 131, or 154 as an initial course.

(4). Both the total score and the quantitative score on the ACE have some limited value in the prediction of success in an initial mathematics course.

(5). The Mathematics Screening Test developed by the University of Houston is the best single predictor of success in a student's initial mathematics course.

(6). Success in Mathematics 030 is not a significant indicator of success in a second or subsequent mathematics course.

(7). Success in Mathematics 153 or Mathematics 131 is a good indicator of success in the next or succeeding mathematics course.

(8). There is a tendency for students to pass their initial mathematics course more frequently when the course is taken during their first semester in school; however, this tendency is not statistically significant.

(9). Mathematics 153 significantly improves the mathematical background of deficient students so they can successfully compete with the more adequately prepared students.

Microfilm $2.00; Xerox $5.00. 99 pages.

PROJECTIONS IN CERTAIN CONTINUOUS FUNCTION SPACES

(L. C. Card No. Mic. 58-5402)

David William Dean, Ph.D.
University of Illinois, 1958

A Banach space B is said to have property P if for every Banach space Y and X a subspace of Y, a bounded linear map μ from X to B can be extended to a bounded linear map μ_1 from Y to B. If there is a t such that μ can always be taken so that $|\mu_1| \leq t|\mu|$, then B is said to have property P_t. If μ_1 exists when Y is required to be separable, B is said to have properties S and S_t respectively. Property P is equivalent to the property P_t for some t. If B is separable, then property S is equivalent to the property that if B is subspace of a separable Y, then there is a projection of Y onto B and B has property S_t for some t.

If B is a subspace of a Banach lattice Y and if p is a positive projection of Y onto B, then letting $b \leq 0$ in B mean there is a $y \geq 0$ in Y such that py = b, B becomes a Banach lattice which has a unit if Y has, and which is a complete lattice if Y is. Hence if B is a subspace of C(H) and H is an extremally disconnected compact Hausdorff space, then B can be made a complete Banach lattice whose unit ball has a least upper bound. Such a B is isomorphic to a space with property P_1. If H is as above and $C(H) = B \oplus X$ where X is finite dimensional, then B is isomorphic to a space with property P_1. If the map μ defined by $\mu(b + x) = b - x$ for all b in B and x in X is such that $|\mu| = 1$, and if H is as above, then one can find sets W and V such that $W \cup V = H$, $W \cap V$ is empty, and B is equivalent to $C_W(H)$, X is equivalent to $C_V(H)$ where $C_V(H)$ is the subspace of C(H) of functions vanishing on V.

A new proof of Sobcyzk's result that c_0 has property S_2 is given and it is shown that property S_1 implies property P_1. If Y is separable and contains c as a subspace, then there is a subspace c_1 of c equivalent to c and a projection p of Y onto c_1 such that $|p| = 1$.

Microfilm $2.00; Xerox $3.00. 33 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

INVARIANT MAPPINGS BETWEEN PARTIALLY ORDERED VECTOR SPACES

(L. C. Card No. Mic 58-3942)

Richard Thomas Dillon, Ph.D.
University of Oregon, 1958

Adviser: Paul Civin

A partially ordered vector space is said to be regular if there is an element $e_v \in V$ such that for every $x \in V$ there is a scalar a for which $-ae_v \leq x \leq ae_v$. A partially ordered vector space is said to have the least upper bound property (LUBP) if every set which has an upper bound has a least upper bound.

Let X be a subspace of a partially ordered vector space Y with positive cone C. Let V be a regular partially ordered vector space with the LUBP and let f_0 be a linear function defined from X to V. The function f_0 is said to be a bounded monotone function if there is a convex radial set $S \subset Y$ such that $\{f(x) : x \in X \cap y + S + C\}$ has a lower bound for each $y \in Y$. In Section 3 of this thesis it is shown that a necessary and sufficient condition that f_0 can be extended to a monotone linear function defined from Y to V is that it be a bounded monotone function. A few consequences of this condition are also given.

Let X, Y and V be as above and let G be a semi-group of distributive operators on Y. Let f_0 be a linear function from X to V. In Section 4 necessary and sufficient conditions are given for the extension of f_0 to a linear function f from Y to V where first f is invariant under G and secondly that f be both monotone and invariant under G.

Finally let X, Y, G and V be as above where, in addition, $gX \subset X$ for each $g \in G$ and $gy \geq 0$ for each $y \geq 0$ and each $g \in G$. In Section 5 it is established that for certain groups or semi-groups G, a bounded monotone function defined from X to V which is invariant under G can be extended to a monotone invariant (under G) linear function from Y to V.

Microfilm $2.00; Xerox $4.60. 88 pages.

OPERATOR MATRICES AND SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS

(L. C. Card No. Mic 58-3968)

Ben Fitzpatrick, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Professor H. J. Ettlinger

The system of n first order linear partial differential equations $Lu = f$ is considered, where $L = (L_{ij})$, $u = (u^i)$, $f = (f^i)$, $L_{ij} = \sum_{k=1}^{n} M_{ij}^k D_k$, M_{ij}^k is a real number, i, j, k = 1, 2, ..., n, and D_k is the partial derivative operator $\frac{\partial}{\partial x^i}$. If a non-singular linear transformation of co-ordinates is introduced, $D_k = \sum_{m=1}^{n} A_{km} \bar{D}_m$, there is obtained an equivalent system. If the resulting operator matrix L can be diagonalized by a real equivalence transformation, the system is readily solvable. It is shown that the reducibility of an operator matrix L does not depend on the commutativity of the D_i's; that is, the matrix L with non-commutative elements can be so diagonalized if and only if the corresponding matrix L' with commutative elements can be so diagonalized. Then, assuming commutativity, necessary and sufficient conditions for the reducibility of an operator matrix to diagonal form are obtained. Furthermore, necessary and sufficient conditions for the reducibility of an operator matrix to diagonal form by a real orthogonal transformation are obtained. If these conditions are satisfied, the system $Lu + cu = f$, where c is a constant, is reduced to the previous case $Lu = f$. Some of the results are generalized to the complex case.

Microfilm $2.00; Xerox $3.00. 46 pages.

HARMONIC HYPERVARIABLES

(L. C. Card No. Mic 58-5455)

Loren Robert McMurray, Ph.D.
University of Illinois, 1958

This paper continues a study of an algebra developed by Ketchum.[1] Ketchum considered an algebra with an infinity of units and proved that many theorems of complex variables concerning monogenic functions generalize to monogenic functions of a restricted hypervariable in this algebra. In particular, the conjugate functions of a monogenic function are harmonic and give the complete solution to Laplace's three dimensional equation.

Chapter I consists of an introduction to the above algebra and a linear transformation of the units to a new basis to simplify the computational aspects of the algebra.

In Chapter II operations with hypernumbers of this algebra are discussed. A one to one correspondence between functions having a Fourier series representation and a certain subset of hypernumbers is established. This correspondence proves to be very useful in understanding some of the properties of hypernumbers. Other subsets of hypernumbers are introduced and pairs of zero-divisors and pairs of inverses are classified according to which subset they do or do not belong. Idempotents, nilfactors, and the "Dirac delta hypernumber" are also studied.

Several theorems pertaining to these hypernumbers have a close resemblance to theorems which appear in other topics such as Fourier series analysis. This results from the fact that a hypernumber has several different interpretations, e.g., (1) a vector in an infinite dimensional space, (2) a sequence of complex numbers, or (3) an ordered set of coefficients of an infinite series. The above correspondence between hypernumbers and functions having a Fourier series uses this last interpretation. The approach used in this paper is to use theorems of Fourier series analysis to prove theorems about hypernumbers; however, the reverse approach has interesting possibilities. By using the various possible interpretations of hypernumbers, the theorems about hypernumbers might motivate corresponding theorems in other topics and help unify several concepts.

In Chapter III, a proper subset of monogenic functions whose members are called absolutely monogenic functions is defined and it is shown that (1) the product of two absolutely monogenic functions is an absolutely monogenic

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function, (2) a function of a function can be defined such that an absolutely monogenic function of an absolutely monogenic function is an absolutely monogenic function, and (3) the analytic continuation of a complex valued function of a real variable is an absolutely monogenic function. Properties (1) and (2) are not true for monogenic functions in general.

The completeness theorem states that if the function f(x,y,z) is harmonic, then there exists at least one monogenic function which has f(x,y,z) as its zero conjugate function. Actually there are many monogenic functions with this property and in Chapter IV the problem of finding the "simplest" such function is considered. A criterion of simplicity is defined and it is shown that the simplest function exists and is unique. A Taylor series method and a Cauchy-Riemann equation method of constructing the simplest monogenic function from the given zero conjugate function f(x,y,z) are given.

In Chapter V, the possibility of using monogenic functions to solve boundary value problems is briefly discussed. A method of solving the Dirichlet problem is given; however, it is of theoretical interest only and would not be used in practice. Microfilm $2.00; Xerox $4.40. 85 pages.

1. Ketchum, P. W., A Complete Solution of LaPlace's Equation by an Infinite Hypervariable, American Journal of Mathematics, vol. 51 (1929),pp. 179-188.

POTENTIAL REPRESENTATIONS IN INTEGRAL EQUATIONS

(L. C. Card No. Mic 58-5470)

Edward Allen Newburg, Ph.D.
University of Illinois, 1958

W. J. Trjitzinsky[1] has obtained logarithmic potential representations in the plane of the form

$$(I)\quad F(x,y) = \iint_W f(u,v)\,\ln\frac{1}{r}\,du\,dv + h(x,y)$$

for classes of functions F(x,y) which are designated in this paper as classes R and B_μ. In (I), W is a bounded domain, r is the euclidean distance between the points (x,y) and (u,v), and h(x,y) is a function harmonic in W.

The problem of obtaining a representation of the form (I) for a given function F(x,y) may be stated as follows: Given the function F(x,y) of a suitable class, determine the function f(x,y) so that F(x,y) has the representation (I) with h(x,y), unspecified beforehand, harmonic in W. This paper considers the following generalization of that problem: Given the function F(x,y) of a suitable class, and a kernel k(x,y;u,v), determine the function f(x,y) so that F(x,y) will have a representation of the form

$$(II)\quad F(x,y) = \iint_W f(u,v)\;k\;(x,y;u,v)\,\ln\frac{1}{r}\,du\,dv + h(x,y)$$

with h(x,y), unspecified beforehand, harmonic in W. The solution of the problem consists of establishing the conditions under which (II) is equivalent to a regular Fredholm integral equation in the function f(x,y), for which the theorems of existence of solutions are known, and in specifying that Fredholm equation. Equivalence of two integral equations is to mean that every solution of one is a solution of the other and vice versa.

The principal results of this paper are contained in three theorems. One of these establishes conditions under which functions F(x,y) of class R will have a representation (II) with f(x,y) bounded almost everywhere in W. The second gives conditions which are sufficient for functions F(x,y) of class B_μ to have a representation (II) again with f(x,y) bounded almost everywhere in W. The third theorem extends the results of the second to include functions f(x,y) which are essentially unbounded. Necessarily, the hypotheses of the third theorem are more restrictive than those of the second. Microfilm $2.00; Xerox $3.00. 43 pages.

1. Trjitzinsky, W. J., "Mixed Laplacians and Potential Representations," Annali di Matematica pura ed applicata, 31 (1950), 143-230.

A GENERALIZATION OF SINGULAR INTEGRAL EQUATIONS WITH COMPLEX KERNELS

(L. C. Card No. Mic 58-5477)

Raymond Peter Polivka, Ph.D.
University of Illinois, 1958

The singular integral equation

$$(1)\qquad \theta(x) - \lambda\int_0^1 K(x,y)\,\theta(y)dy = f(x)$$

has been investigated by T. Carleman for real symmetric kernels. W. J. Trjitzinsky has extended that investigation for complex valued kernels with symmetric real and imaginary parts of type B_c. He defines a kernel of type B_c to be a complex valued kernel $K(x,y) = K'(x,y)+iK''(x,y)$ which is L_2 in x and y separately, and for which there exists a sequence of regular symmetric complex valued kernels $K_n(x,y)$ such that

1. $K_n(x,y)$ is L_2 in (x,y), $|K_n(x,y)| \le |K(x,y)|$;
2. the characteristic functions of $K_n(x,y)$ are real;
3. $K_n(x,y) \to K(x,y)$ as $n \to \infty$;
4. $\int_0^1 [K_n(x,t) - K_n(x',t)]^2 dt < d(x,x')$ where d(x,x') is independent of n and $d(x,x') \to 0$, as $|x - x'| \to 0$.

In the present investigation a more general kernel of type C is treated. A measurable complex valued kernel with symmetric real and imaginary parts, approximated by a sequence of regular kernels satisfying the above conditions 1 through 3 is called a kernel of type C. By deleting all L_2 conditions on the kernel K(x,y), one does not have sufficient information to state the explicit solution of equation (1). In order to treat these more general kernels of type C, one must introduce a linear operator $L_x(\xi\,|\,f(x))$ and thereby get a different type of functional integral equation with which to work. Motivated by Carleman's work, the linear operator shall possess the following properties:

i) $\int_0^1 L_x(\xi|K(x,y))^2\,dy$ exists

ii) $L_x(\xi|K_n(x,y)) \leq B(\gamma;y)$, where B is L_2 in y and independent of n;

iii) $L_x(\xi|K_n(x,y)) \to L_x(\xi|K(x,y))$ as $n \to \infty$

iv) $L_x(\xi|f_n(x)) \to L_x(\xi|f(x))$ if $f_n(x) \to f(x)$ weakly;

v) $L_x(\xi|\int_0^1 K_n(x,y)g(y)dy) = \int_0^1 L_x(\xi|K_n(x,y))\,g(y)dy$ where g(y) is any L_2 function.

Given such an operator, one is able to show the existence of a solution for the singular integral equation

$$(2)\quad L_x(\xi|\theta(x)) - \lambda\int_0^1 L_x(\xi|K(x,y))\,\theta(y)dy = L_x(\xi|f(x))$$

where:

1. K(x,y) is of type C, and
2. λ is in Q, Q being the set in the complex plane complementary to the closure of the set of characteristic values λ_{nv} of the approximating kernels, $K_n(x,y)$, (n,v = 1,2, . . .).

To get a spectral representation for the solution of equation (2), one must develop the spectral function $\Omega(x,y;e)$ corresponding to K(x,y). First, however, one defines the spectral function $\theta_n(x,y;e)$ for the regular approximating kernels $K_n(x,y)$ as

$$\theta_n(x,y;e) = \sum_{\lambda_{mv}\in e} u_{nv}(x)u_{nv}(y)$$

where λ_{nv} and u_{nv} are the characteristic values and functions respectively of $K_n(x,y)$, (n,v = 1,2, . . .) and e is any bounded set in complex plane. Then by defining

$$\Omega_n(x,y;e) = \int_0^x\int_0^y \theta_n(s,t;e)ds\,dt$$

and applying repeatedly the Frostman theorem with the usual diagonal process, one can show that

$$\lim_{n_j\to\infty} \Omega_{n_j}(x,y;e) = \Omega(x,y;e).$$

With this spectral type function, one may prove this theorem:

THEOREM

The solution of the integral equation,

$$L_x(\xi|\theta(x)) - \lambda\int_0^1 L_x(\xi|K(x,y))\,\theta(y)dy = L_x(\xi|f(x)).$$

where

1. λ is in Q,
2. K(x,y) is of type C.
3. the linear operator, $L_x(\xi|g(x))$ satisfies the above five conditions (i) through (v),

can be expressed as

$$\theta(x) = f(x) + \frac{\partial}{\partial x}\int_0^1 f(y)\,\frac{\partial}{\partial y}\int_{E(0,\infty)}\frac{1}{\mu-\lambda}\,d_\mu\Omega(x,y;e)dy$$

for almost all x in [0, 1] and for any function f(x) L_2 in [0, 1]. The set $E(0,\infty)$ is the complex plane, i.e., $0 \leq |\lambda| \leq \infty$ and $0 \leq$ angle $\lambda < 2\pi$.

Microfilm $2.00; Xerox $3.00. 50 pages.

FINITE GROUPS OF AUTOMORPHISMS OF ALGEBRAIC FUNCTION FIELDS

(L. C. Card No. Mic 58-5487)

Burnett Henry Sams, III, Ph.D.
University of Illinois, 1958

Finite groups are studied from the point of view of generators and defining relations, and they are represented as groups of automorphisms of algebraic function fields.

Theorem: Let (K,F) be an algebraic function field in one variable, and let G be a finite group of K-automorphisms of F having fixed field F^G. If the residue class fields of F are separable extensions of the corresponding residue class fields of F^G, if F^G has genus zero, and if the ramification structure of F relative to F^G consists of three places, each of degree one, having as ramification indices distinct primes not divisible by the characteristic of K, then G contains a normal subgroup N such that F is an unramified extension of F^N. F^N considered as an extension of F^G has the same ramification structure as F over F^G, and G/N is a simple group.

Let G be a finite group of order n represented as a quotient group of a free group F on r generators $c_1, \ldots, c_r$. Let c_o denote the inverse of $c_1 \ldots c_r$, and let e_i denote the order of c_i. Let R denote the kernel of relations. Let W denote the minimal normal subgroup of F containing $c_o{}^{e_o}, \ldots, c_r{}^{e_r}$; the corresponding relations are called W-relations. An automatic digital computer has been programed to calculate a set of free generators for R and to search for independent generators of R/W.

F is isomorphic to the fundamental group of a sphere with r - 1 points removed, and R corresponds to a covering surface of the punctured sphere of genus $g = 1 + \frac{n}{2}(r - 1 + \sum_{i=0}^{r} 1/e_i)$. R is the free subgroup of F generated by elements a_α, b_β, $d_{i,j}\,c_i{}^{e_i}\,d_{i,j}{}^{-1}$ for $1 \leq \alpha, \beta \leq g$, $0 \leq i \leq r$, $1 \leq j \leq n/e_i$; for each i, $d_{i,1} = 1$. The relation $[a_1, b_1] \ldots [a_g, b_g]\; d_{0,1}\,c_0{}^{e_0}d_{0,1}{}^{-1} \ldots d_{r,n/e_r}\,c_r{}^{e_r}\,d_{r,n/e_r}$ is trivial in F. For each i, the set of elements $d_{i,j}\,c_i{}^k$ for $j = 1, \ldots, n/e_i$ and $k = 0, \ldots, e_i - 1$ is a complete set of right coset representatives for F/R. R = W if, and only if, g = 0. W F' $\supset$ R if, and only if, F' $\supset \{a_\alpha, b_\beta\}$. R is finite over W[F,R] when G is perfect. A representation is called simply perfect if F = W F'; this occurs if, and only if, $e_o, \ldots, e_r$ are relatively prime in pairs. Except when the covering surface has genus zero, there are infinitely many finite groups possessing a given set of W-relations. Classes of extensions which preserve the W-relations and a class of abelian extensions are studied.

The modular group M of integral linear fractional transformations of the Riemann sphere is isomorphic to the factor group of a free group F on two generators, a and b, modulo $a^2 = b^3 = 1$. Let M_q denote the subgroup of M consisting of all those transformations which become equivalent to the identity transformation when the coefficients are taken modulo q. Let R_q denote the subgroup of F corresponding to M_q. Let W_q denote the minimal normal subgroup of F containing a^2, b^3, and $(ab)^q$. If n_q is the order of M/M_q, then M_q is free on $1 + n_q/6$ generators. $R_m \supset W_m$ and $W_1 = F$; if m is a multiple of n, then $R_m \subset R_n$ and $W_m \subset W_n$; $R_m \cap R_n = R_{[m,n]}$ and $W_m \cap W_n \supset W_{[m,n]}$; $R_m R_n = R_{(m,n)}$ and $W_m W_n = W_{(m,n)}$, and $W_m R_n = R_{(m,n)}$.

Microfilm $2.00; Xerox $3.80. 67 pages.

ABSTRACT MARTINGALE CONVERGENCE THEOREMS

(L. C. Card No. Mic 58-5490)

Frank Salvatore Scalora, Ph.D.
University of Illinois, 1958

Corresponding to the Dunford integral, we show that there exists a weak conditional expectation of a random variable having its value in a Banach space, and a strong conditional expectation corresponding to the Bochner integral. It is then possible to define weak and strong X-martingales. A strong X-martingale, for example, is a collection of X-valued random variables, together with corresponding Borel fields of measurable sets $\{x_t, \mathcal{F}_t, t \in T\}$ such that x_t is Bochner integrable and strongly measurable relative to $\mathcal{F}_t$ or equal almost everywhere to such a function, $\mathcal{F}_s \subset \mathcal{F}_t$ for $s < t$, and $\mathcal{E}\{x_t \mid \mathcal{F}_s\} = x_s$ with probability 1 for $s < t$, where $\mathcal{E}\{x_t \mid \mathcal{F}_s\}$ is the strong conditional expectation of x_t given $\mathcal{F}_s$.

If X is a reflexive Banach space and $\{x_n, \mathcal{F}_n, n \geq 1\}$ is a strong X-martingale such that $E\{\|x_n\|\} \leq K < \infty$ for every n, then there exists a strongly measurable random variable x_∞ such that $x_n \to x_\infty$ weakly with probability 1; that is, $f(x_n(\omega)) \to f(x_\infty(\omega))$ as $n \to \infty$ with probability 1 for every f in X*. If instead we assume that $\{\|x_n\|, n \geq 1\}$ is a uniformly integrable class of functions, we prove the more powerful result that $\|x_n(\omega) - x_\infty(\omega)\| \to 0$ as $n \to \infty$ with probability 1, and $\{x_n, \mathcal{F}_n, 1 \leq n \leq \infty\}$ is an X-martingale. The thesis ends with a discussion of the applications of the main theorems to standard Banach spaces, such as l^p, $L^p(I)$, and C(I).

Microfilm $2.00; Xerox $3.00. 54 pages.

CONCERNING LOCALLY PERIPHERALLY SEPARABLE SPACES

(L. C. Card No. Mic 58-5094)

Leon Bruce Treybig, Ph.D.
The University of Texas, 1958

Supervisor: R. L. Moore

In his paper On a Property Related to Separability in Metric Spaces, Journal of the Elisha Mitchell Scientific Society, vol. 70, no. 1, June, 1954, F. Burton Jones indicated that the question whether or not every connected, locally peripherally separable, metric space is separable seemed to remain unanswered. In this dissertation the author answers the question in the negative by showing that there exists a connected, semi-locally-connected, and aposyndetic space S satisfying R. L. Moore's axioms O and C, in which every region has a separable boundary, every pair of points is a subset of some separable continuum, and the set of all points at which S is not locally separable is separable.

It is also shown that every compactly connected space which satisfies these axioms, and in which every region has a separable boundary, is separable.

Microfilm $2.00; Xerox $3.00. 26 pages

ABSOLUTELY CONTINUOUS SOLUTIONS OF $u_{xy} = f(x,y,u,u_x,u_y)$

(L. C. Card No. Mic 58-5095)

Don Harrell Tucker, Ph.D.
The University of Texas, 1958

Supervisor: Dr. H. J. Ettlinger

Definitions for nondecreasing, bounded variation, absolutely continuous and Lipschitz conditions for functions of two variables are given and certain properties are listed. A definition for a derivative D of a function of two variables is given, and it is shown that every function which is of bounded variation over a rectangular disk possesses such a derivative almost everywhere in that disk. It is shown that the first partial derivatives of a function which satisfies a Lipschitz condition over a rectangular disk and of bounded variation along the sides of that disk exist almost everywhere in that disk. These are used to establish the following:

Theorem. Suppose a and b have ranges [0,X] and [0,Y] respectively a(0) - b(0) = c and have a Lipschitz constant K over their ranges, R is the disk

$$[0,X;0,Y;-2k,k;-(K+X),K+X;-(K+Y),K+Y]$$

where $K = \max\begin{cases} |a(x)| & 0 \leq x \leq X \\ |b(y)| & 0 \leq y \leq Y, \end{cases}$

f is continuous over R, M is the max $|f|$ over R, there exists a number $L \geq 0$ such that

$|f(x,y,z,v,w) - f(x,y,z,v',w')| \leq L\{|v-v'| + |w-w'|\}$ over R,

$A = \min\left\{X, \frac{k}{K+MY}\right\}$ and $B = \min\left\{Y, \frac{k}{K+MX}\right\}$. There exists a function U defined on [0,A;0,B] such that

$$U(x,y) = a(x)+b(y)-c+\int_0^x\int_0^y f(t,{}^1t,{}^2U(t,{}^1t,{}^2)U_x(t,{}^1t^2),U_y(t,{}^1t^2),$$

for each point P(x,y) in [0,A;0,B] where the integration is in the sense of Lebesgue, U(0,y) = b(y);U(x,0) = a(x),U(0,0) = c and DU(x,y) = f(x,y,U(x,y)U_x(x,y),U_y(x,y)) almost everywhere on [0,A;0,B].

Microfilm $2.00; Xerox $3.00. 45 pages.

CONCERNING THE HAUSDORFF INCLUSION PROBLEM

(L. C. Card No. Mic 58-5100)

James Howard Wells, Ph.D.
The University of Texas, 1958

Supervisor: H. S. Wall

The statement that the function ϕ is quasicontinuous on [a,b] means that $\phi(x+)$ exists for $a \leq x < b$, and $\phi(x-)$ exists for $a < x \leq b$. The statement that the real number sequence a is a Q-sequence means there is a quasicontinuous ϕ on [0,1] such that

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$$a_p = \int_0^1 x^p \, d\emptyset(x) \, , \; p = 0, 1, 2, 3, \ldots$$

Necessary and sufficient conditions for a number sequence to be a Q-sequence are given. Then, the mean Stieltjes integral is used in connection with a Stieltjes integral equation to formulate the inclusion problem for nonregular Hausdorff transformations determined by Q-sequences. Finally, an integral of fractional order is used to determine a set of necessary and sufficient conditions for a regular Hausdorff method of convergence to include (C,k), the Cesaro method of nonnegative order k.

Microfilm $2.00; Xerox $3.00. 47 pages.

PHARMACOLOGY

AN EVALUATION OF HUMECTANTS IN COSMETIC EMULSIONS

(L. C. Card No. Mic 58-3164)

Gerald Christian Henney, Ph.D.
Purdue University, 1958

Major Professors: G. J. Sperandio and R. V. Evanson

Experiments were conducted to evaluate the ability of selected humectants to reduce water loss from a simple vanishing cream. The physical properties produced by these materials were also evaluated by visual observation.

Samples of the creams containing up to 25% humectant, in 5% increments, were exposed to room temperature and humidity and a controlled temperature of 30°C. and a 60% to 70% relative humidity range for thirty days. Each cream sample was weighed at twenty-four hour intervals to determine the weight loss. Inasmuch as the other ingredients in the simple vanishing cream were relatively non-volatile, the loss of weight was considered as being equal to the loss of weight of water. The per cent water loss was calculated as per cent loss from the total water content in the sample.

Observation of the physical properties produced by the various humectants indicates that the creams prepared with 1,3 butylene glycol were the hardest in consistency, the cream containing polyethylene glycol 400 was the next hardest and the creams prepared with sorbitol, propylene glycol and glycerine were about equal in consistency, but softer than the other creams. Vanishing creams prepared with higher concentrations of butylene glycol and propylene glycol developed sheen almost immediately after preparation. In lower concentrations, sheen development required twenty-four hours. Sheen was negligible or undetectable in creams containing the other humectants. Gloss was present in some cases and absent in others.

After thirty days exposure to a 10% to 20% relative humidity range, creams containing sorbitol lost less water than the cream with no humectant. The water loss decreased as the concentration of the humectant was increased; however, a 20% sorbitol concentration produced optimum water retention in the test cream. The effectiveness of the other humectants varied. In some cases water loss was greater than the water loss from the cream with no humectant.

In the 60% to 70% relative humidity range, water loss decreased as the concentration of the humectant was increased, except with the 25% concentration of sorbitol and butylene glycol. Glycerine was the most effective material in all concentrations, and the 10% glycerine concentration was the most effective in terms of water retention for amount of humectant added to the product. A 5% concentration of polyethylene glycol 400 was almost as effective as the 5% concentration of glycerine; however, the increase in water retention became less dramatic as the concentration of the humectant was increased.

The rate of water loss from the creams was almost linear, in most cases, during the first twenty-one days exposure at both humidity ranges. The per cent water loss after twenty-eight days declined slightly from a linear line drawn through the per cent loss after seven and fourteen days exposure. In some cases water loss departed from this pattern; however, this general trend was evident with most materials and in most concentrations. The decline from this linear trend probably was a result of smaller amounts of water remaining in the cream samples and/or an increase in the ability of the humectants to reduce evaporation or residual water as the humectant becomes concentrated. This trend is significant inasmuch as it may permit the predicting of maximum water loss from a formulation by plotting a linear line through per cent loss after seven and fourteen days exposure to specific temperature and humidity conditions. It may also provide a means of reducing the time and labor necessary in evaluating the effectiveness of humectants in reducing water evaporation from specific formulations.

Inasmuch as a cosmetic product will be exposed to varying conditions of temperature and humidity, it is desirable to employ a humectant capable of providing optimum humectancy at different relative humidities. Sorbitol seems best qualified to fulfill this criteria; however, if a manufacturer is able to anticipate the humidity conditions to which his product will be exposed, humectant selectivity is possible. Humectant selection, however, must also include selection on the basis of the physical properties desired for the finished product.

Microfilm $2.00; Xerox $6.20. 126 pages.

THE EVALUATION OF TABLET LUBRICANTS USING A CONVENTIONAL TYPE TABLET MACHINE INSTRUMENTED WITH STRAIN EQUIPMENT

(L. C. Card No. Mic 58-3175)

Stanley Leonard Markowski, Ph.D.
Purdue University, 1958

Major Professor: H. George DeKay

The tablet, invented by Wm. Brockendon in 1843, has gained steadily in popularity until the present day when it has become an integral part of the pharmaceutical industry. New developments are constantly arising and thus the turn towards the study of the physical aspects of tablet production which has been prevalent in the past few years.

This investigation involves: (a) establishing a definite means for the evaluation of lubricants; (b) the determination of a test procedure for obtaining such an evaluation; (c) selecting instruments by which data needed for such a study could be obtained; (d) selecting materials and subjecting them to such an evaluation.

The principles involved in the instrumentation are based on stress analysis making use of the SR-4 electric strain gage. The gages were installed on the small diameters of the steel punches. The punches were calibrated using a 10,000 pound Tinius Olsen Testing Machine noting the output on the Baldwin Portable Strain Indicator. The Brush BL-310-S Strain Analyzer and BL-202 Double Channel Magnetic Recording Oscillograph were used to measure and record the upper punch forces; while the Ellis Bridge Amplifier and Meter, the DuMont Cathode Ray Oscillograph, and the DuMont Type 321 Oscillograph Record Camera were used to measure and obtain the lower punch and ejection forces. The recordings which were obtained were translated to the punch forces by applying the calibration data.

Preliminary tests involving a comparison of the instrumentation used for this investigation to instruments used in a previous test to substantiate it for further use was carried out. The instrumentation was found accurate as a means of obtaining the forces involved in the tabletting operation.

In the lubrication tests, five lubricants were tested on each of four granulations in the following percentages: 1/2%; 1%; 1 1/2%; 2%. The granules were sized to sieve No. 12-20 and the records for twenty tablets were obtained. The results were used to obtain an average R-value and an average ejection force for each combination of lubricant and granulation. The R-value is a ratio of the lower punch force to the upper punch force.

The stearates were found to be very efficient lubricants with sodium stearate being the most efficient. The efficiency of the stearates seemed to indicate that there was a relationship between molecular size or valence of the metal and the lubricating efficiency. For it was found that sodium stearate was the most efficient lubricant and afforded the lowest ejection force whereas aluminum stearate was found to be the least effective lubricant.

High R-values obtained for unlubricated granulations indicated fissuring. Both phenacetin and aminopyrine tablets fissured after compression and high R-values were obtained for their unlubricated granulations.

The lower punch film recording was indicative of the type of granulation being compressed. The film recording for an unlubricated granulation was erratic indicating that forces other than compression and ejection were acting on the punch; whereas, the film recording for a lubricated granulation was definite and the compression and ejection forces were clearly indicated.

Microfilm $2.00; Xerox $7.00. 150 pages.

METAL COMPLEXES OF TETRACAINE HYDROCHLORIDE AND RELATED LOCAL ANESTHETICS

(L. C. Card No. Mic 58-3187)

Herbert A. Platt, Ph.D.
Purdue University, 1958

Major Professor: Dr. A. N. Martin

A study was undertaken to qualitatively and quantitatively determine the binding of inorganic metal ions, notably copper (II), to Tetracaine Hydrochloride and the related local anesthetics, Procaine Hydrochloride and Monocaine Hydrochloride.

Qualitatively, by potentiometric means, it was found that copper (II) ions complexed with the Hydrochlorides of Tetracaine, Procain and Monocaine. To a lesser degree, nickel (II) also formed a complex with Tetracaine Hydrochloride.

Quantitatively, also by potentiometric means, the stability constants of the complex compounds were determined. Two methods of calculation of the stability constant were introduced and applied. The calculations yielded results with the same relative degree of accuracy. These procedures were also applied to known complex compounds of copper and amino acids and were found to be reasonably accurate.

Tetracaine Hydrochloride was found to bind, in an intermediate manner, to copper-amino acid complexes. The stability constants of these complexes were also determined.

Variation of the ionic strength of the solutions did not have any apparent effect on the stability constant of the complex; the pK'_a of the tetracaine, as expected, was found to vary with ionic strength.

A biological evaluation of the copper-tetracaine complex, by means of the guinea pig corneal and wheal tests, were performed to observe any changes in the duration and the degree of action that might have been brought about by complexation. A statistical analysis of the results indicate that the complex decreased the degree of sensory anesthesia as determined by the wheal test.

Microfilm $2.00; Xerox $5.20. 105 pages.

PHYSICS, GENERAL

THE THERMAL CONDUCTIVITY OF IMPURE TIN AT LOW TEMPERATURES

(L. C. Card No. Mic 58-3902)

Arnold Sander Boxer, Ph.D.
The University of Connecticut, 1958

A comparative study has been made of the effect of small concentrations (up to 0.3 atomic %) of mercury, bismuth, and lead on the thermal conductivity and residual electrical resistivity of tin at low temperatures. Both measurements were made on the same specimen and during the same experiment.

Tin specimens, consisting of rods, of 1 mm. diameter and 11 cm length, were mounted in a vacuum chamber immersed in liquid helium. One end of a rod projected into the helium bath whereas the other end carried a small carbon film heater. To determine the temperature gradient along the specimen two carbon film thermometers were deposited at two points of the rod 4 cm. apart. The resistances of the thermometers were measured with precision Wheatstone bridges; the heater power and the electrical resistivities of the specimens were determined with potentiometers.

The residual resistivity in each case was very nearly proportional to the impurity. At a given percentage of impurity, the bismuth was most effective in reducing the thermal conductivity of tin, whereas the lead impurity was the least effective. In both the normal and the superconducting states, the temperature dependence of the thermal conductivity exhibited the usually observed behavior of metals at low temperatures, namely, that of going through a maximum. The data in general indicated that the thermal conductivity could be attributed to electronic conduction dominated by impurity scattering. Due to the scatter of the data it was generally found difficult to draw any definite conclusions about the actual functional dependence of the thermal conductivity on the temperature. When one subtracts from the conductivities of the most impure specimens a term of the first power in T (corresponding to the Wiedemann-Franz law) one obtains conductivities that are roughly proportional to T^2. These may perhaps be ascribed to lattice conduction, the part that is due to electron scattering.

For most specimens the temperature behavior of the ratio of thermal conductivity in the superconducting state to that in the normal state showed good agreement with Heisenberg's theoretical formula. Although generally at the low temperature end the experimental curves fell appreciably above the theoretical curve. The effect was most marked in the case of bismuth.

Microfilm $2.00; Xerox $4.20. 74 pages.

ANNIHILATION OF POSITRONS IN ALKALI HALIDE CRYSTALS

(L. C. Card No. Mic 58-3961)

Louis Brown, Ph.D.
The University of Texas, 1958

Supervisor: Walter E. Millett

An apparatus for the measurement of the mean lives of positrons in condensed materials was constructed and applied to annihilations in materials that manifest no long component. It was observed that the measurement of the absolute value of short components (ca. 10^{-10} sec) to the accuracy heretofore reported is not possible with existing techniques because of instrumental effects not previously considered. This explains in part the variations between the results reported by other observers for the same material. The accuracy of relative measurements is not affected by this instrumental effect and the mean lives of positrons in alkali halide crystals have been studied relative to the mean life in aluminum. A report of a long component in aluminum was investigated with considerably better resolution than the original observer employed and was found either not to exist or to represent a much smaller fraction of the annihilation processes than reported. Existing theories of annihilation in ionic crystals were examined in the light of the present measurements but none predicted a satisfactory mean life. Other models were proposed but no satisfactory theory was devised that explains both lifetime and momentum distribution measurements in these crystals.

Microfilm $2.00; Xerox $4.20. 77 pages.

ALPHA-PARTICLE IRRADIATION OF GERMANIUM AT 4.2°K

(L. C. Card No. Mic 58-5560)

Garth William Gobeli, Ph.D.
Purdue University, 1958

Major Professor: Karl Lark-Horovitz

Employing a sealed polonium-210 alpha-particle source having an effective energy of 3.73 Mev, degenerate n-type and p-type germanium samples were irradiated at 4.2°K. The temperature was maintained by admitting small amounts of helium exchange gas to the sample-source chamber. In samples held for 20 hours at 4.2°K following irradiations no changes in the electrical properties were observed. Carriers were removed in both n-type and p-type material showing a linear dependence on flux up to 50% carrier concentration changes. Removal rates calculated from Hall coefficient give 2.84×10^4 electrons/alpha

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particle-cm in n-type samples and 0.662×10^4 holes/alpha particle-cm in p-type samples. A calculation of lattice displacements, employing a displacement threshold energy of 30 ev, yields 2.79×10^4 displacements/alpha particle-cm. The Hall mobility in both n-type and p-type material exhibited a marked decrease during the irradiations. The mobility changes in n-type samples are much larger and more sensitive to the irradiation flux than in p-type material.

Thermal annealing in degenerate n-type and p-type germanium samples after irradiation at 4.2°K was studied up to 78°K. Isochronal annealing indicates that no measurable thermal recovery occurs in any sample for annealing temperatures below 22°K and subsequent annealing at 20.4°K for 14 hours confirms this result. Definite thermal recovery is observed by annealing at 26°K for 20 minutes. Experiments at 78°K show that the amount of thermal recovery of radiation induced carrier concentration changes in n-type and p-type samples is essentially the same (25% and 22%). Electrical resistivity measurements taken while the samples were warmed up to 78°K indicate two distinct regions of thermal recovery, with maximum rates of change occurring near 32°K and 66°K. Subsequent isothermal annealing at 26°K, 33°K and 50°K confirm that the two regions are completely separable. The low temperature process is found to follow a first order reaction with a unique thermal activation energy of about 0.017 ev. The higher temperature process does not yield to simple analysis. Microfilm $2.00; Xerox $4.20. 79 pages.

APPROXIMATIONS TO THE ELECTRIC MICROFIELD DISTRIBUTION FUNCTION IN IONIZED GASES

(L. C. Card No. Mic 58-3870)

Horace E. Hoffman, Ph.D.
The University of Oklahoma, 1958

Major Professor: Otto H Theimer

In 1919 Holtsmark investigated the microfield within a plasma. His results and their subsequent modification by other investigators have not been experimentally confirmed. An examination of current statistical theories has been made, revealing two defects which admit the modification presented in this paper.

In two approximations, the mutual shielding of positive and negative charges in a plasma is formally handled by means of the Debye-Huckel theory of strong electrolytes. A first approximation to the microfield distribution function is made by assuming the only field source is the nearest neighbor of an arbitrary point within an ionized gas. The results obtained show that the polarization of the plasma by point charges produces marked deviations from previous theory. A second, more rigorous approximation is made employing Markoff's method. Again, the shielding effect is found to produce strong deviations from the original Holtsmark distribution. The two approximations agree in case of high ion concentrations and low temperatures. In each case an explicit temperature and density dependence of the distribution function is demonstrated and graphical representations of the functions are presented. The essential result is a strong shift of the distribution maximum toward weak fields and a reduction of its half width.

The shielding correction should modify the shape of spectral lines as strongly as the time dependence of the microfield which was also neglected by Holtsmark. However, the shielding effect and the velocity correction can certainly cancel each other on the wings of the spectral line. Their combined effect is complicated and no attempt has been made to discuss it.

Microfilm $2.00; Xerox $3.00. 58 pages.

X-RAY ABSORPTION EDGES OF Zn AND Cu IONS IN SOLUTIONS OF WATER AND ALCOHOL

(L. C. Card No. Mic 58-3974)

Eugene Carl Huebschmann, Ph.D.
The University of Texas, 1958

Supervisor: Dr. H. P. Hanson

X-ray absorption edges of Cu and Zn compounds of $Cu\,Br_2$ and $Zn\,Br_2$ in water and alcohol solutions were investigated. The edges were found to be independent of the concentrations studied in the range .01-4M. However, the visible appearance of the copper solution varied with the concentration, becoming brownish after the concentration exceeded 1 molar. This color was observed at any concentration in alcohol. The particular absorption band in the violet which made the solution brown was ascribed to a charge transfer spectra within the complex structure as $Cu\,Br_4$.

An extensive qualitative discussion was given using resonance theory to analyze large extinction coefficient and the inability of $Zn\,Br_4$ to absorb in the 500 mμ region. Other theories, including the crystal field theory, were found inadequate.

The absorption band of Cu around 900 mμ was found to be a direct function of the copper concentration. The crystal field about the atom was adequate to allow for this absorption. Zn of course does not have any d orbitals to be split by a crystal field and thus does not absorb in this region.

Some of the copper compounds investigated had a charge transfer spectra, but this did not effect the X-ray edge. The results with either type of compound showed the same edge structure and were presented graphically. Finding the same edge structure was not too surprising since very few ls to 4p or charge transfers occur; thus one type of absorption did not lower the other's probability for a transition. It may be revealing, however, that inner p levels were not greatly altered by outer π orbitals.

Change of solvent had no effect on the copper edge but greatly altered the zinc edge. This was explained on the basis of asymmetry that existed with the Zn complexes in alcohol solutions. Microfilm $2.00; Xerox $3.00. 59 pages.

EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN SILICON

(L. C. Card No. Mic 58-5459)

Michael Francis Millea, Ph.D.
University of Illinois, 1958

The diffusivities of P, Sb, Sn and In in "intrinsic" (10^{15} impurity atoms/cm^3 or less), heavily doped n-type (5×10^{19} atoms/cm^3), and heavily doped p-type (2×10^{20} atoms/cm^3) silicon have been measured to obtain information on the way diffusion takes place. The measured diffusivities of P and Sb in n-type are twice their values in intrinsic silicon; their diffusivities in p-type are one half those in intrinsic silicon. These changes are in the direction expected for vacancy diffusion. The diffusivity of Sn in n-type is about 50% larger than in intrinsic, whereas in p-type it is about equal to that in intrinsic silicon. Opposite changes are found for the diffusivity of indium; it is about 6 times larger in p-type and about 50% lower in n-type than in intrinsic silicon. Possible diffusion mechanisms for substitutional impurities in silicon are discussed in the light of these and other data.

Microfilm $2.00; Xerox $3.60. 63 pages.

INVESTIGATIONS INTO THE THEORY OF HIGH ENERGY ACCELERATORS

(L. C. Card No. Mic 58-3502)

John Joseph Murphy, Ph.D.
The University of Florida, 1958

The stability of ion orbits in a high energy ($E_T = 2\ m_o c^2$) spiral ridge cyclotron is investigated. The linear theory is first presented for small displacements of the ions from their equilibrium orbits. The results are well known. For fixed frequency operation the ions oscillate radially about their equilibrium orbits with a frequency approximately equal to their total energy in rest mass units. Vertical oscillations occur with a frequency depending on the flutter and the spiral parameters of the machine as well as the energy defocusing effect. The coupling of the radial and vertical focusing frequencies and the magnet periodicity of the machine is expected to exhibit resonance behavior affecting the orbit stability at several points during the acceleration. An analytical treatment of the non-linear effects is discussed in relation to orbits lying in the median plane, where the only coupling is between the radial oscillations and the magnet periodicity. A set of equations for the motion amenable to computation is developed and solved with the use of an analog computer. The computer and computational techniques are described in detail. It is shown that the results in the vicinity of the important resonance near $E_T = 2\ m_o c^2$ are in reasonable quantitative agreement with the theory for motion confined to the median plane. Adding the vertical motion and the coupling terms, results were obtained at energies of $1.6\ m_o c^2$ and $2\ m_o c^2$ for several sets of flutter and spiral parameters. The motion is violently unstable at the latter resonance, but relatively quiet at the former. The vertical frequency appears to be more strongly controlled by the radial oscillation, which is independent of flutter and spiral, than by the machine parameters. It is concluded that the analog computer is capable of solving the cyclotron equations in a quick, efficient manner, and it should be quite useful in optimizing machine parameters over the entire range of acceleration. Further attention should also be given to the theory of the coupled motion.

Microfilm $2.00; Xerox $5.80. 117 pages.

THE EFFECT OF PRESSURE ON SOLID STATE SPECTRA

(L. C. Card No. Mic 58-5497)

Thomas Edward Slykhouse, Ph.D.
University of Illinois, 1958

High pressure cells containing pressed sodium chloride windows and using sodium chloride as the pressure transmitting fluid were used to generate pressures up to 250,000 atmospheres and obtain the optical absorption spectra of solids. Optical absorption edges of several solids were studied as a function of pressure in this range in order to determine how the electronic energy levels of solids change with large changes in density at constant temperature.

Four intrinsic semiconductors were studied, three of them, (silicon, gallium arsenide and gallium antimonide) to 50,000 atmospheres, and one of them, (germanium) to 100,000 atmospheres. The optical absorption edges of silver chloride, bromide and iodide were studied to 210,000, 260,000, and 190,000 atmospheres respectively. Sulfur was observed to 200,000 and potassium iodide to 160,000 atmospheres.

Large shifts of the optical absorption edges were observed for the four semiconductors. Silicon was found to shift "red" (to longer wavelengths) up to 50,000 atmospheres at a rate of about -3.8×10^{-6} ev/atm. Germanium shifted 1400 cm^{-1} "blue" (to shorter wave lengths) up to 35,000 atmospheres (at $\alpha = 0$), and then red up to 100,000 atmospheres. Gallium arsenide shifted blue all the way to 50,000 atmospheres at a rate of 8.8×10^{-6} ev/atm with only a slight decrease of the rate of shift in the last 10,000 atmospheres. Gallium antimonide initially shifted blue at a rate of 12.3×10^{-6} ev/atm but almost stopped shifting at 50,000 atmospheres.

From what is known about the band structure of the above semiconductor materials at one atmosphere, it is concluded that the $\langle 100 \rangle$ minimum, which is the lowest point in the conduction band of silicon at one atmosphere, moves to lower energies as the density increases. The $\langle 111 \rangle$ minimum, which is the lowest point in the conduction band in germanium at one atmosphere, and probably for gallium arsenide and antimonide also, moves to higher energies relative to the valence band as the density increases. The reversal of shift in the case of germanium is interpreted as the result of the upward motion of the $\langle 111 \rangle$ minimum at low pressures and the downward motion of the $\langle 100 \rangle$ minimum at high pressures, with the two minima being at the same energy at approximately 35,000 atmospheres. The $\langle 100 \rangle$ and $\langle 111 \rangle$ minima appear to approach each other near 50,000 atmospheres in gallium antimonide, but not in gallium arsenide.

Silver chloride and bromide show small red shifts in the entire pressure range studied with red shifts at the

transition from the sodium chloride to caesium chloride structure of 1000 cm^{-1} for the bromide at 83,000 atmospheres, and 870 cm^{-1} for the chloride at 87,000 atmospheres. Silver iodide has a 2600 cm^{-1} red shift at the 2900 atmosphere transition from the wurtzite to sodium chloride structure, a continuous shift from 3000 to 110,000 atmospheres, a blue shift of 1250 cm^{-1} accompanying a new transition observed at 110,000 atmospheres, and a very slight red shift from there to 200,000 atmospheres.

Sulfur was found to shift red at a rate of -7.2×10^{-6} ev/atm below 100,000 atmospheres. Using the best possible extrapolation of the shift of the absorption edge with density indicates that it should become a metal at about 400,000 to 500,000 atmospheres.

Potassium iodide shifted about 4000 cm^{-1} in 167,000 atmospheres, and showed peculiar behavior in the low pressure region near the phase transition.

Pressure experiments on the peaks appearing in the silver iodide and cuprous bromide absorption spectra at 428 mμ and 378 mμ respectively indicate that these shifts are probably due to internal transitions in the metal ions.

Microfilm $2.00; Xerox $5.40. 110 pages.

A PARAMAGNETIC RESONANCE STUDY OF COPPER DOPED SILVER CHLORIDE

(L. C. Card No. Mic 58-5506)

Ronald Forest Tucker, Jr., Ph.D.
University of Illinois, 1958

Moser, Nail, and Urbach have reported that copper is an efficient sensitizing agent for photolysis in silver chloride. The present work gives the results of paramagnetic resonance studies of copper doped silver chloride in three different states. In state I, air or vacuum annealed crystals, no resonances were observed at room temperature or at 77°K. Illumination of state I crystals at room temperature and at 77°K did not produce an observable resonance. In state II, crystals which were annealed in a chlorine atmosphere, a resonance spectrum was observed at 77°K which was attributed to Cu^{++} in three different types of sites, all having approximately tetragonal symmetry. These different centers are interpreted as 1) type A has an associated vacancy at a nearest neighbor positive ion site, 2) type B has an associated vacancy at a next nearest neighbor positive ion site, and 3) type C has no associated vacancy near-by, but has a sizeable Jahn-Teller distortion of the surrounding octahedron of chlorine ions. The spectrum due to these centers was observed to vary with temperature in a manner which is attributed to vacancy motion near the Cu^{++} ions. An estimate is made of the activation energy for this motion. The line widths observed are attributed to hyperfine interaction with the neighboring chlorine nuclei, and an estimate is made of the amount of covalent bonding between the Cu^{++} and the Cl^{-} ions.

State III is produced by cold working state II crystals. No resonances were observed in state III crystals. Mild heat treatment of state III crystals in an inert atmosphere restored the state II resonances.

Speculations are offered as to the role of the copper ion in the photolytic process in silver chloride, and further experiments are suggested.

Microfilm $2.00; Xerox $3.60. 63 pages.

EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN GERMANIUM

(L. C. Card No. Mic 58-5509)

Milton William Valenta, Ph.D.
University of Illinois, 1958

The diffusion coefficients of indium (In^{114m}), antimony (Sb^{124}), arsenic (As^{76}) and tin (Sn^{113}) were measured in As-doped, intrinsic and Ga-doped germanium over a temperature range of from 750 to 875°C. The heavily doped, n-type specimens contained about 10^{19} arsenic atoms/cm^3 and the heavily doped, p-type germanium specimens contained about 10^{19} gallium atoms/cm^3. Antimony, arsenic and tin were diffused into the three types of germanium from a very thinly deposited surface layer of the corresponding tracers, while indium was diffused into the bulk by maintaining the germanium samples in the vapor of the indium tracer. Diffusion coefficients were obtained from the penetration curves (concentration of the tracer versus the distance from the surface) observed after annealing. In the former case (thin, tracer surface layer) a Gaussian penetration curve was obtained and in the latter, an error function complement.

Donor (arsenic and antimony) diffusivities in the heavily doped, n-type samples ranged from about 1.3 to 2.7 times the corresponding ones in intrinsic germanium, and those in heavily doped, p-type germanium ranged from about 0.55 to 0.65 times the corresponding ones in intrinsic germanium. If donors associate with negative vacancies, as would be expected from the positive charge of the diffusing impurity, donors would diffuse more rapidly in n-type than p-type germanium. This follows since it can be shown that the donor diffusivity is essentially proportional to the concentration of vacancies and, if vacancies are assumed to behave as acceptors, the concentration of vacancies will be greater in n-type than p-type germanium. The above values (1.3 to 2.7 and 0.55 to 0.65) are in order of magnitude agreement with values calculated from the shift in the Fermi level due to doping.

The change, due to doping, in the acceptor (indium) diffusion coefficients was relatively smaller than in the case of donors, although the change was in the same direction, i.e., the acceptor diffusivity is greater in n-type than p-type germanium. Since acceptors become negatively charged on diffusing into the germanium lattice, it might be expected that acceptors would associate with neutral vacancies. As the neutral vacancy concentration is independent of the position of the Fermi level, the acceptor diffusivity would be independent of doping. From the observation that the acceptor diffusivity does vary with doping and is greater in n-type than p-type germanium, one is led to assume that acceptors also associate, to some extent, with negative vacancies.

The tin diffusivity is also greater in n-type than p-type germanium. The ratios of the tin diffusivities in doped to intrinsic germanium are in fairly good agreement with the ratios in the corresponding vacancy concentrations.

It is concluded that the substitutional group III, IV and V impurities diffuse in germanium probably by association with vacancies. Donors, because of their positive charge, probably associate with negative vacancies; acceptors probably associate with both neutral and negative vacancies. This is consistent with the assertion that the vacancy acceptor level is close to the valence band, for then the concentration of negative vacancies greatly exceeds the

concentration of neutral vacancies; furthermore, the fact that donors diffuse more rapidly than acceptors is explained by the greater negative than neutral vacancy concentration. Finally, from the agreement between the observed and calculated changes, with doping, in the tin diffusion coefficients, tin also probably diffuses in germanium by association with vacancies.

Microfilm $2.00; Xerox $3.60. 64 pages.

TRANSIENT PHOTOCONDUCTIVITY IN SILVER CHLORIDE AT LOW TEMPERATURES

(L. C. Card No. Mic 58-5511)

Roger Steven Van Heyningen, Ph.D.
University of Illinois, 1958

Primary photoconductivity in single crystals of pure AgCl has been investigated in the temperature range 6.5°K to 80°K by using low intensity monochromatic light pulses and a sensitive electrometer. In the region of fundamental optical absorption, the photoresponse as a function of wavelength and applied electric field has been found to be strongly dependent on the condition of the illuminated surface. This behavior may be explained by a theory in which it is assumed that a thin layer near the surface has a different density of traps than the volume of the crystal. The range of electrons was found to be long in an air grown crystal, $\sim 10^{-3}$ cm^2/volt, and relatively short in a vacuum grown crystal, $\sim 10^{-6}$ cm^2/volt, at 80°K. In both air and vacuum grown crystals the range of holes was not measurable. At 80°K an upper limit for hole range of $\sim 10^{-8}$ cm^2/volt was established. The yield of free electrons per absorbed photon (quantum efficiency) as a function of wavelength and temperature has been determined from the experiment. In all crystals the measured quantum efficiency showed structure and was high, decreasing from ~0.7 at the optical absorption edge through the first absorption peak to ~0.1 at 220 mμ. The quantum efficiency was the same at 35°K as at 80°K and was comparable at 6.5°K. There was no evidence that the quantum efficiency decreased in the absorption peak with decreasing temperature. Trapping greatly reduced the electron range at low temperatures (10^{-3} cm^2/volt at 80°K; 10^{-9} cm^2/volt at 6.5°K). Characteristics of the most important traps can be deduced from prominent electrical glow peaks at 15°K, 36°K, and 180°K, as well as from current decay measurements and trap filling experiments at fixed temperatures. The deep, 0.55 ev, traps are present in concentrations of $\sim 10^{10}$ cm^{-3} (air grown crystals) to $\sim 10^{13}$ cm^{-3} (vacuum grown crystals) and have a large cross section, $\sim 10^{-12}$ cm^2. The shallow traps are in much higher concentration.

Microfilm $2.00; Xerox $5.40. 106 pages.

LENGTH AND RESISTIVITY CHANGES OF GERMANIUM UPON LOW TEMPERATURE DEUTERON IRRADIATION AND ANNEALING

(L. C. Card No. Mic 58-5514)

Frederick Ludwig Vook, Ph.D.
University of Illinois, 1958

Simultaneous measurements of length and resistivity of high purity germanium single crystals were made upon irradiation and annealing. The specimens were initially irradiated at 25°K with deuterons of average energy 10.2 Mev to an integrated flux of 6.2×10^{16} deuterons/cm^2 and annealed to room temperature. The specimens were then irradiated at 85°K to an additional flux of 9.2×10^{16} deuterons/cm^2 and annealed to 364°K. The specific length expansion for both bombardments was found to be $\Delta L/L = 1.5 \pm 0.2 \times 10^{-21}$/ deuteron/cm^2. The annealing for both runs showed a gradual recovery of the expansion beginning at approximately 200°K with recoveries of approximately 50% by 300°K and 85% by 360°K. The resistivity measurements agreed generally with previous results. An irreversible resistivity increase occurred on annealing between 85°K and 140°K. The resistivity decreased irreversibly by a factor of 10^3 between 150°K and 200°K.

The irreversible annealing curves of the resistivity and volume expansion therefore do not show parallel behavior. If the damage is interpreted in terms of point defects, and if the length change recovery is caused by interstitial-vacancy annihilation, then the resistivity changes on annealing below 200°K are possibly caused by the association of defects in various cluster models. A possible cluster model that can explain the present length and resistivity changes on bombardment and annealing, as well as recent small angle X-ray scattering data consists of clusters of interstitials and vacancies not centered at the same point. It is possible that the vacancy and interstitial clusters may be produced directly upon irradiation in a rather coarse distribution suggested by previous small angle scattering data at ~90°K. If so, present displacement theories are in serious error. Microfilm $2.00; Xerox $3.80. 66 pages.

PHYSICS, ELECTRONICS AND ELECTRICITY

A NEW PHOTOMETRIC REFLECTANCE METHOD FOR THE DETERMINATION OF THE OPTICAL CONSTANTS OF CRYSTALS

(L. C. Card No. Mic 58-3339)

John R. Johnson, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. K. R. Atkins

A new photometric method for the determination of the real and imaginary parts of the complex index of refraction for both isotropic and anisotropic substances has been developed. The method consists of determining the angle of incidence at which one encounters the minimum

reflectance for the parallel polarization, and the ratio of the reflectances for the parallel and perpendicular polarizations at that same angle of incidence. A requirement of this method is that the absorption of the specimen be such as to give a measurable minimum reflectance, but still give a small imaginary part to the complex index of refraction. The method is experimentally simple, and gives an error of several tenths of a percent for the real part of the complex index. The results yielded by this method, however, differ widely from those of transmission measurements on strontium titanate and rutile. It is shown that these discrepancies can be accounted for by postulating the existence of a layer with different optical properties on the surface of the specimen. Because of this sensitivity to surface conditions, the method can be used as a tool for the study of surfaces.

In order to determine how large a part of the crystal participates in the reflection process, an attempt was made to treat the reflection process from a microscopic point of view. The crystal is regarded as an array of point scatterers (dipoles) and the transmission of light in thin crystalline films is considered as a multiple scattering process. A crucial part of this approach is numerical in nature. Results are readily obtained for static fields, and the dielectric constant can be calculated. For oscillating fields, however, the difficulties involved with the numerical method are large enough to render the technique impractical for the treatment of thick films. The calculations were carried out for films up to five lattice constants thick. Although it is not possible to see the full reflection process from such thin films, it is clear that these films do not behave in the manner described by the usual macroscopic approach. Microfilm $2.00; Xerox $6.80. 141 pages.

PHYSICS, METEOROLOGY

A STUDY OF TYPHOON MICROSEISMS

(L. C. Card No. Mic 58-3979)

Roman Lucero Kintanar, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Claude W. Horton

The Philippines, because of its geographical location, is affected by several typhoons every year. With the aim of utilizing microseismic observation as an aid to the conventional meteorological methods of typhoon tracking, a research in microseisms is in progress. The present investigation is made to correlate measured amplitudes of microseisms detected at Diliman, Quezon City, Philippines with the distance to and the intensity of typhoons which entered the Philippine Area of Responsibility.

Twenty typhoons and their associated microseismic activities during the period from 1949 to 1954 were chosen for investigation on the basis of the qualification that the microseismic activities are mainly attributable to the typhoons and not grossly affected by extraneous atmospheric disturbances such as thunderstorms or frontal activity.

A description of instruments used in observation and methods used in gathering of data is given. In the analysis, the assumption is made that the microseismic energy at a station (E_s) is related to the energy at a point source (E_{so}) by the formula

$$E_s = \frac{E_{so}\, e^{-k\, r_o\, \phi}}{r_o \sin \phi} \qquad \text{(after Gutenberg)}$$

where r_o is the radius of the earth, ϕ is the angular distance from station to source, and k is the extinction factor. An approximation is made for small ϕ, and, since the source of microseismic energy includes the whole area of disturbed winds, an integration over this area is made.

The differential equation used is

$$(*) \qquad dE_s = c\, f(V_o)\, I(V_o)\, \frac{e^{-\alpha\rho}\, e^{-kr}}{r}\, da$$

where r is the linear distance from source area (da) to station, ρ is the distance from da to the center of the disturbance, and V_o is the maximum wind velocity at or near the center of the disturbance. The portion $c\, f(V_o)\, I(V_o)\, e^{-\alpha\rho}$ arises from the transformation of wind energy to microseismic energy and the consideration of the wind velocity distribution in the disturbed area which is expressed by a relation of the form $V/V_o \propto e^{-\alpha'\rho}$.

The equation (*) is integrated and the energy E_s of the microseismic wave is related to the amplitude A of the microseisms. When the constants in this relationship are evaluated by fitting the experimental data, one has

$$A^2 = 0.0316 \times 10^6\, e^{.0837 V_o} e^{-2 \times 10^{-4} \Delta} (\Delta^{-1} + .0615\, \Delta^{-2} + 307\, \Delta^{-3} + 15.8\, \Delta^{-4} + \ldots)$$

This approach involves the implicit assumption that the effects of differences in the geologic structure of the paths traversed by the microseismic waves and the meteorological factors other than intensity and distance of the typhoon are minor and random in nature, i.e. factors tending to increase the amplitude occur as often as factors tending to decrease them.

The inherent approximations involved in the analysis and their significance to the applicability of the derived formula are discussed. It is pointed out that a quantitative relation between microseismic amplitude and distance to and intensity of a typhoon would enable an investigator to evaluate the variations in amplitude that may be attributable to other factors and thus make further correlations practicable.

The possible utilization of microseismic observation in conjunction with the results of this investigation as an aid to meteorological methods for weather work is also cited.

Microfilm $2.00; Xerox $4.60. 87 pages.

PHYSICS, NUCLEAR

AN IRON-FREE DOUBLE-FOCUSING SPECTROMETER AND THE SPECTRUM ANALYSIS OF GOLD-199 ABOVE 15 KEV

(L. C. Card No. Mic 58-5264)

Quincey Lamar Baird, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor S. K. Haynes

A double-focusing, beta-ray spectrometer using no ferromagnetic materials for the production of its focusing field has been constructed at Vanderbilt University. The spectrometer is designed to permit accurate intensity measurements of electron spectra involving both low and relatively high energies in the same spectrum, and to obtain good luminosity at high resolution. This latter feature is very desirable for the study of low specific activity isotopes.

The main features of the spectrometer are the focusing coils with an electric current control circuit, a vacuum chamber having a source mount at one end and a side-window Geiger counter at the other end, and a baffle system to limit the electron trajectories to certain allowed paths. The accessories include two oil diffusion pumps with a mechanical fore-pump to maintain the vacuum, an ionization gauge and thermocouple gauge to measure the pressure, a Geiger counter filling system, a high voltage supply for the counter, a scaling and recording system for the counter output and a coil system to compensate for the earth's magnetic field.

The spectrometer is designed to use field currents from 0.5 ampere to 43 amperes. A current control system was developed which sets the value of the field current within this range and controls this current to an accuracy of $1:10^4$.

About one-half of this thesis consists of a description of the spectrometer and its accessories. The remainder is a report on the first experimental study made with the spectrometer, a study of the K-Auger and conversion line spectra of mercury-199 following the beta decay of gold-199.

Gold-199 decays by one of three beta groups to the ground state or one of two excited states of mercury-199. These two excited states decay to the ground state by gamma emission. Since the upper level may decay by cascade or crossover there are three resultant gamma rays of 50, 159, and 209 kev in energy. Two of these are energetic enough to produce conversions in the K shell. The intensities of these conversion lines were determined and the ratio of the intensity of the K-Auger electrons to the sum of these provided a measure of the total K-Auger yield for mercury. It was determined to be 0.048 ± 0.003, which is in good agreement with the value expected from semi-empirical relations already known. The ratios KLL:KLX:KXY were determined as 1.00:0.496:0.094, which are in agreement with certain previous measurements. The good resolution (about .3%) of the instrument permitted the separation of the constituent lines of the KLL Auger spectrum as well as the L-subshell conversion lines of the three electromagnetic transitions. A determination was made of the subshell intensities and also of the total K, L, M and N intensities. These values showed general disagreement with the point-coulombic conversion coefficients but there were indications from the K-shell case that the finite size consideration would yield fair agreement. Microfilm $2.00; Xerox $4.80. 94 pages.

SCINTILLATION STUDIES OF SOME NEUTRON DEFICIENT ISOTOPES OF LUTECIUM

(L. C. Card No. Mic 58-5405)

Lowell Thomas Dillman, Ph.D.
University of Illinois, 1958

Scintillation studies of neutron deficient lutecium isotopes have been made using a 100-channel pulse height analyzer and associated equipment. Activities associated with Lu^{170} and Lu^{172} have been produced by irradiating a lutecium oxide sample with bremsstrahlung of maximum energy, 250 Mev. Activities associated with Lu^{173} and Lu^{174} have been produced by irradiating a lutecium oxide sample with bremsstrahlung of maximum energy, 24 Mev. Previously observed rotational levels in Lu^{170}, Lu^{172} and Lu^{174} have been confirmed. Gamma-gamma coincidence experiments have led to a proposed partial level scheme for Yb^{172}. In this level scheme, comparison of observed relative intensities (of transitions from a given level to various members of a rotational band) with theoretical predictions has been made. Many coincidence experiments have been performed with the Lu^{173} and Lu^{174} activities, but no decay schemes have been attempted. Lu^{174} has been observed to decay both by electron capture and by beta minus emission. The first excited level following beta minus emission is at 84 ± 2 kev. An upper limit to the K-conversion coefficient for this transition has been measured to be 2.2 ± 0.3.

Microfilm $2.00; Xerox $5.80. 120 pages.

NUCLEAR BINDING ENERGY FROM THE INDEPENDENT PARTICLE MODEL

(L. C. Card No. Mic 58-5271)

Martin Leon Gursky, Ph.D.
Vanderbilt University, 1958

Supervisor: Dr. David L. Hill

Two aspects of nuclear binding energy are discussed from the viewpoint of the independent particle model (IPM). On the one hand, the binding energy per particle is calculated on the basis of the IPM. It is necessary to assume that all potentials are two-body in nature and include a velocity dependent potential characterized by the existence of an effective mass, m^*. The results are based on a calculation of an asymptotic expression for the sum of eigenvalues as a function of the number of nucleons accommodated by occupied levels, subject to the exclusion principle. A technique for obtaining these asymptotic expressions is developed and applied to several simple potential wells. The exact and asymptotic results are compared to demonstrate the validity of the results. For a nuclear model based on a finite square well it is found

that good agreement is possible between predicted and observed binding energy curves for reasonable values of the model parameters. In addition, it is shown that the variation of the nuclear radius with A can also be predicted by the independent particle model. While the results obtained in the binding energy calculation are sensitively dependent on the assumed ratio of effective mass to actual mass, the nuclear radius results are largely independent of m^*/m.

Having demonstrated the validity of using an independent particle model to calculate binding energies, we then use a simple anistropic oscillator model to calculate binding energies as a function of nuclear shape for an arbitrary number of particles. It is found that, except for certain unique numbers of nucleons (closed shells), the energetically preferred nuclear shapes are not necessarily spherical. The shape is found to depend on the number of nucleons being accommodated and need have no axial symmetry at all.

In addition to relating binding energies to the independent particle model the wave functions and energy levels for various IPM potentials are calculated. After considering the standard harmonic oscillator and spherically symmetric square well, results are obtained for a truncated oscillator potential as well as a rounded bottom infinite potential well. The latter is a potential which interpolates between the harmonic oscillator and the infinite square well in that the energy levels as well as the predicted particle distributions fall between the two extremes of the infinite square well and the harmonic oscillator.

Microfilm $2.00; Xerox $7.20. 152 pages.

ANGULAR DISTRIBUTION MEASUREMENTS OF THE $B^{10}(d,p)B^{11}$ REACTION AT LOW DEUTERON ENERGIES

(L. C. Card No. Mic 58-5273)

Gordon Ray Harrison, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor C. D. Curtis

Angular distribution measurements have been made for the first three proton groups from the $B^{10}(d,p)B^{11}$ reaction at deuteron energies of E_d = 0.296, 0.260, 0.213 Mev. An angular distribution of the ground state group was also measured at E_d = 0.173 Mev. Differential and total cross sections were obtained at all the deuteron energies.

The angular distributions were measured from 0^0 to 140^0 (lab system) by means of a scintillation spectrometer. A 1 mm thick CsI(Tl) crystal mounted on an RCA 5819 photomultiplier tube was used in the detector head of the spectrometer. The CsI crystal response for protons was found to be linear within experimental error up to 8.6 Mev.

A 300 Kev Cockcroft-Walton Accelerator was used to produce the deuterons. The targets were prepared by vacuum evaporation of enriched B^{10} from small carbon boats by resistive heating. Targets of thicknesses of 50 to 70 ugm/cm^2 could be prepared quite readily.

Relative proton yields were measured to less than 2% accuracy while absolute differential and total cross sections were measured with accuracies of the order of 10% due largely to insufficient knowledge of target thickness. The results are in very good agreement with some other work done in this energy region by previous investigators.[1] Microfilm $2.00; Xerox $6.00. 123 pages.

1. C. H. Paris, E. P. G. Valckx, and P. M. Endt, Physica 20, 573 (1954).

SCINTILLATION STUDIES OF TERBIUM^{156} AND TERBIUM^{154}

(L. C. Card No. Mic 58-5429)

Richard Warfield Henry, Ph.D.
University of Illinois, 1958

Stable Tb^{159} was irradiated with bremsstrahlung of maximum energy 250 Mev from the University of Illinois 300-Mev betatron to produce 7.5-hour and 21.5-hour Tb^{154} and 5.5-hour and 5.35-day Tb^{156}. The raditions were studied with scintillation and coincidence techniques and using an R. I. D. L. 100 channel pulse height analyzer.

Gamma rays at 89 ± 1, 112 ± 3, 200 ± 2, 350 ± 7, 535 ± 5, 1060 ± 10, 1150 ± 10, 1210 ± 10, and 1410 ± 10 kev were associated with the 5.35-day activity. These had the relative intensities 46 ± 10, 25 ± 5, 66 ± 11, 31 ± 8, 100 ± 11, 33 ± 12, 26 ± 9, 54 ± 16, and 21 ± 5, respectively. Gamma rays at 88 ± 1, 123 ± 3, 180 ± 5, 250 ± 3, 340 ± 10, 511 ± 10, 640 ± 15, and others >1600 kev were associated with the three shorter-lived activities. Gd K x-rays were detected with half-lives of 5.35 days and approximately 20 hours. Weak positron activities of approximately 8 hours and 5 days were observed.

Levels in Gd^{156} (with tentative spin and parity assignments) were observed at 89(2+), 289(4+), 1150(1+or-), 1500(3+or-), and 2035 kev. These follow electron capture in 5.35-day Tb^{156}, which has been given a tentative spin and parity assignment of 0-.

The K-shell conversion coefficients of the 89- and 200-kev transitions in Gd^{156} were calculated to be about 1.0 and 0.24, respectively.

Some coincidence relationships were established among the gamma rays of the shorter-lived activities but no level schemes were constructed.

Microfilm $2.00; Xerox $4.60. 87 pages.

PART I. HIGHER ORDER EFFECTS IN BETA DECAY
PART II. THE BETA-GAMMA CORRELATION AND TIME REVERSAL INVARIANCE

(L. C. Card No. Mic 58-5437)

Icko Iben, Jr., Ph.D.
University of Illinois, 1958

In Part I interferences between allowed and second forbidden matrix elements in the beta-neutrino directional correlation are obtained. The resulting distribution function is used as a tool to investigate the $P^{32} \rightarrow S^{32}$ transition. The P^{32} decay is assumed to be Δl-forbidden so that the magnitude of the allowed matrix element must be

obtained by comparison with the experimental ft value. By using s and d shell model wave functions, the pertinent second forbidden matrix elements are calculated and the effect of interferences between allowed and higher order matrix elements on the decay probability is presented. Since the predicted deviation of the energy spectrum from the allowed shape compares favorably with the experimental points of Porter, Wagner, and Freedman, it is concluded that shell model assignments in the region of P^{32} and S^{32} are probably correct and that the assumption of $\Delta\ell$-forbiddenness as an explanation for the P^{32} decay is a good one.

In Part II the distribution function for the first forbidden beta-gamma correlation including beta transverse polarization terms is presented and discussed in connection with the question of time reversal invariance. It is found that in the high ($\alpha Z/2R$) limit, that is, for most first forbidden decays, a very definite quantitatively determinable relation exists between the ordinary directional correlation asymmetry and the beta polarization dependent asymmetries in the distribution function. In this limit it is found that time reversal testing terms appear in the same manner in all the asymmetries but are dominated in general by non time reversal testing terms. For the particular case of Au^{198} it is shown that experimental results are consistent with time reversal invariance but also with a violation of time reversal invariance over a wide range below maximum violation. It is concluded that an investigation of the asymmetries for other beta-gamma cascades can show, at most, that time reversal invariance is violated. The extent to which it is or is not violated cannot be determined by such an investigation.

Microfilm $2.00; Xerox $5.80. 118 pages.

AN IRON-FREE, DOUBLE-FOCUSING, BETA-RAY SPECTROMETER AND THE ANALYSIS OF THE L-AUGER SPECTRUM OF GOLD-199---MERCURY-199

(L. C. Card No. Mic 58-5278)

Julian Clark Nall, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor S. K. Haynes

An iron-free, double-focusing, beta-ray spectrometer of the Moussa-Bellicard type has been constructed at Vanderbilt University. This instrument has been designed to incorporate the features of very-low-energy reliability, high resolution, and high transmission.

The main components of the Vanderbilt spectrometer are: 1) a vacuum chamber with its associated baffle system, source mounting device, and pumping system; 2) a set of focusing coils; 3) a field-sensitive control circuit for the focusing field; 4) a continuous-flow Geiger-Muller counter; 5) a Helmholtz coil system to compensate the earth's magnetic field.

The first objective of this thesis is a detailed description of the design, construction, alignment, and performance of the field-sensitive control system for the focusing coils of the spectrometer. A d.c. generator supplies the current for the focusing coils. The output noise of the generator is highly attenuated by incorporating this unit in the output of a negative feedback amplifier. Since the generator responds poorly at high frequencies, a by-pass for these frequencies is provided and the entire system is adjusted to satisfy the Nyquist criterion. The field-sensitive control system actually controls the spectrometer field itself and not just the current through the focusing coils. Two coils are attached to opposite ends of a long shaft which is rotated at approximately 21 cycles per second. One coil rotates in the spectrometer field and the other in a permanent magnet field. The voltage output from the coil in the permanent magnet field is divided by a precision voltage divider which is used to select the desired focusing field. This output is added out of phase to the voltage from the coil in the spectrometer field. The error signal formed is amplified, detected, and then used to control the output of the generator.

The noise level of the generator is reduced to the point where it is about 3 parts in 10^5 of the generator output voltage. In the high current range of the spectrometer, the noise level is somewhat higher. The control circuit maintains a constant spectrometer field to about 1 part in 10^4. The control circuit will allow field settings which will focus electrons in an energy range of less than 0.5 kev to 1.26 Mev. By means of a minor modification, the upper limit may be extended to 1.97 Mev.

The second objective of this thesis is the analysis of the L-Auger spectrum of Au^{199}---Hg^{199}. Data were collected with the spectrometer resolution set at 0.3 per cent, but at very low energies source thickness and back scattering decreased the effective resolution. The source used was Au^{199} which decays by one of three beta groups to the ground state or to one of two excited states of Hg^{199} The de-excitation gamma rays, both cascade and crossover, are internally converted to form the primary vacancies for the Auger process. The L-Auger electrons ejected were counted by means of the spectrometer and the total L-Auger and L-fluorescence yields were calculated. By graphical means, many of the L-Auger lines and line groups were separated. In addition, other lines were separated on the basis of theoretical estimates of the ratios of line intensities. Such a procedure made possible the calculation of the LMM : LMX : LXY ratios, and the relative intensities of various lines and line groups within the spectrum. Two L-subshell Auger yields, one L-subshell fluorescence yield, and the sum of two Coster-Kronig yields were calculated from the spectrometer data and other yields reported in the literature. The results of all of the known L-yield work since 1952 have been tabulated in this thesis.

Microfilm $2.00; Xerox $5.20. 103 pages.

SELF-DIFFUSION IN ALPHA SOLID SOLUTIONS OF SILVER-CADMIUM AND SILVER-INDIUM

(L. C. Card No. Mic 58-5492)

Alan Hugh Schoen, Ph.D.
University of Illinois, 1958

Radioactive tracer diffusion coefficients for both solvent and solute atoms were measured in homogeneous alpha solid solutions of Ag-Cd and Ag-In, in the temperature range between 500°C. and 900°C. Measurements were

made at three different compositions for each of the alloys. In each alloy, the tracer diffusion coefficients were found to obey an Arrhenius equation with constant activation energy and frequency factor. The activation energy for diffusion of both solvent and solute atoms decreases monotonically with increasing solute concentration. The frequency factor shows a small increase with increasing solute concentration in the case of In diffusion in Ag-In alloys, but in the other three cases studied it decreases with increasing solute concentration.

Combining these results with those of Tomizuka, Slifkin, and Sonder on the diffusion in pure Ag of Ag, Cd, and In, it was found that the diffusion coefficients increase at a faster than exponential rate with increasing solute concentration in all four cases studied. A given concentration of In has a greater influence on diffusion rates in Ag-In than the same concentration of Cd has in Ag-Cd. These data, together with the work of Sonder on diffusion in Ag-Sb alloys, indicate that alloying in the dilute range enhances the initially slower solvent diffusion more effectively than it enhances the solute diffusion; the disparity in enhancement increases with the difference in diffusion rates of solute and solvent in a pure Ag lattice for these three solute elements. With higher concentrations of solute, the relative changes in the diffusion rates of solvent and solute in a given alloy become nearly the same.

The experimental results are compared with the work of Nachtrieb, Petit, and Wehrenberg in studies of diffusion in Ag-Pd alloys. In contrast to their findings for the diffusion of Ag in Ag-Pd alloys, it was found that in Ag-Cd and Ag-In alloys, neither solvent nor solute diffusion coefficient is constant along the solidus line, and it is therefore not possible to express the rate of either solvent or solute diffusion in these alloys simply as a function of T/T_m, where T_m is the solidus temperature.

The general tendency for faster diffusion with increasing solute concentration can be qualitatively correlated with the observations of Bacon and Smith on the elastic behavior of Ag-Cd and Ag-In alloys.

Comparison is made with the diffusion theories of Zener, Lazarus, Overhauser, and Hart, Hoffman, and Turnbull. Exact agreement is not found in any case, but some of the predictions of these theories are qualitatively in fair agreement with some features of the data.

Microfilm $2.15. Xerox $7.60. 162 pages.

THE NUCLEAR STRUCTURE EFFECT ON THE ELECTRIC K-CONVERSION COEFFICIENTS

(L. C. Card No. Mic 58-5500)

Yau-Chien Tang, Ph.D.
University of Illinois, 1958

The effect of nuclear structure on internal conversion accompanying electric multipole gamma transitions is studied. It is found that new nuclear matrix elements appear in the expression for the rate of conversion electron ejection which are distinctly different from that responsible for gamma transition of the same multipole order. The occurrence of these matrix elements is a result of the penetration of the electrons into the nuclear charge and current distributions.

With the introduction of these new matrix elements, it is found that the electric multipole K-conversion coefficient of a finite size nucleus is no longer independent of the details of the nuclear wave functions as it is in the case of a point nucleus. In fact, with the assumption of a nuclear model, these matrix elements may be computed and shown to be of practical interest.

In general, the investigation demonstrates that conversion anomalies will commonly appear when the rate of gamma transition is highly attenuated. A crude estimate based on simplified forms of the electonic wave functions shows that the necessary retardation factor is about 10^4 for low energy transitions in heavy nuclei. Exception to this rule has, however, been noticed in several classes of transitions, notably the K-forbidden transitions in spheroidal nuclei and the multi-phonon transitions in nearly spherical nuclei. For those two classes of transitions, the retardation factor may, in certain cases, far exceed 10^4, yet conversion anomalies are not to be expected.

For nuclei best described by the shell model, it is found that the electric K-conversion coefficient would be anomalous for pure neutron transition of multipole order greater than or equal to two. An interesting possibility for the observation of a conversion anomaly also appears when nuclear potential is assumed to have the form of an isoptopic harmonic oscillator. With that assumption there occurs a radial selection rule, the violation of which may lead to highly retarded rate of gamma transition and consequently, conversion anomaly.

For nuclei in the rare-earth and the transuranic regions, collective rotational transitions are shown to have no conversion anomaly. For particle transitions, however, because of the mixing of pure shell-model states, the conversion coefficients may be expected to differ appreciably from those calculated by Sliv.

It is, therefore, concluded that the nuclear structure may be very important in the determination of the electric conversion coefficients. In view of this, it is expedient to note that experimental measurements of the coefficients may sometimes be used as a tool to obtain information concerning the structure of the nucleus.

Microfilm $2.00; Xerox $4.20. 76 pages.

LYMPH FLOW STUDIES IN UNANESTHETIZED DOGS WITH EXTERNAL THORACIC DUCT-VENOUS SHUNTS

(L. C. Card No. Mic 58-5407)

Donald Bernard Doemling, Ph.D.
University of Illinois, 1958

The physiology of lymph flow has long been studied by measuring the rates of flow from cannulated vessels. However since these preparations permit the continuous loss of lymph, the physiological significance of results so obtained is open to question. The shunt preparation circumvents this objection. For these studies, dogs were prepared with a partially externalized thoracic duct-venous shunt made of polyethylene tubing (PE 100, Clay-Adams; I.D. 0.86 mm. x 1.52 mm.). The thoracic duct was cannulated in the neck near its connection to the venous system. To minimize stagnation of lymph around the indwelling portion of the cannula, the tip of the tube was slightly flared and a ligature was placed near the tip. The tube was exteriorized via a stab wound and connected by a short piece of larger tubing (PE 200) to another cannula which had been previously inserted into the precaval vein by way of a branch of the right external jugular vein. A stockinet bandage placed around the neck protected the exposed loop of tubing. No anticoagulants were administered. In twelve such preparations, lymph continued to flow for an average of thirteen days, the range being six to thirty-four days. Each of eleven other dogs had, in addition to the above, an intestinal fistula and/or an hepatic portal vein cannula; in these, lymph flowed for an average of eight days. The intestinal cannula (cf., Pavlov); was placed in the duodenum about four inches anterior to the ligament of Treitz. For the hepatic portal vein cannula, polyethylene tubing (PE 100) was inserted via mesenteric vein; the tubing was tunneled beneath the skin and exteriorized at the dorsum of the neck. When not in use, the cannula was filled with isotonic saline and sealed. For the collection periods, the dogs were loosely restrained and trained to lie on their left sides. To collect lymph the loop of tubing was separated and the lymph permitted to drain into a graduated cylinder. The jugular segment of the opened shunt was available for infusing solutions. Under basal conditions (postcibal for at least sixteen hours and rested for one hour), the rate of thoracic duct lymph flow was approximately one-half ml. per minute. There did not appear to be any correlation between the rate of lymph flow and the size of the animal. Pentobarbital anesthesia decreased the rate of lymph flow approximately twenty-five per cent in three out of four dogs. In twelve out of fourteen experiments, heparin (3000 units, intravenously) stimulated lymph flow. The administration of isotonic saline solution (7.5 ml./kg.) via the intestine (six experiments), hepatic portal vein (eight experiments) or jugular vein (eight experiments) resulted in an increased lymph flow; statistically, there was no difference in effect between the three routes of administration. The intravenous administration of Adrenalin^{R} (5 ug./kg.; 12 experiments) resulted in a marked and sharp increase in the rate of lymph flow. Epinephrine was found to stimulate thoracic duct lymph flow more than norepinephrine (twelve paired experiments). Usually, but not invariably, motility of the duodenum was associated directly with the rate of thoracic duct lymph flow.

Microfilm $2.00; Xerox $4.40. 83 pages.

ASPECTS OF ADRENAL CORTICOSTEROIDOGENESIS, WITH SPECIAL REFERENCE TO CERTAIN INTERMEDIARIES AND TO FACTORS INFLUENCING CORTICOID FORMATION IN VITRO

(L. C. Card No. Mic 58-3097)

John Harris Eichhorn, Ph.D.
Boston University Graduate School, 1958

Major Professor: Dr. Oscar Hechter

This study concerns two aspects of adrenal cortical hormone production; both are intended to contribute to an ultimate understanding of the mechanism of adrenocorticotrophic hormone (ACTH) action. Since the corticosteroidogenic process is stimulated by ACTH, the chemical transformations involved in hormone synthesis must be understood. The first phase of this study utilized radiotracer techniques to resolve uncertainties which existed concerning the roles of 11β-hydroxyprogesterone and 11-deoxycorticosterone (DOC) as intermediaries in the formation of cortisol and corticosterone from progesterone. For this purpose, trace amounts of 11β-hydroxyprogesterone-4-C^{14} and DOC-21-C^{14} were added to incubations of cell-free bovine adrenocortical tissue prepared in a variety of media. The cortisol and corticosterone, which are produced from both endogenous precursors and suitable exogenous precursors by these homogenates, were isolated from lipid extracts of the incubation mixtures by column and paper chromatography. Measurement of the amount and radioactive content of the corticoids formed permitted evaluation of the degree of conversion of DOC-21-C^{14} and 11β-hydroxyprogesterone-4-C^{14} to cortisol and corticosterone, relative to that of a known intermediary, progesterone, incubated under identical conditions. It was found that DOC is converted in good yield to corticosterone, but not in detectable amounts to cortisol. The results support the postulation that cortisol and corticosterone are formed from progesterone via separate pathways. With regard to 11β-hydroxyprogesterone, a limited conversion of this steroid to both cortisol and corticosterone was observed; however, the degree of this conversion relative to that of progesterone indicated that 11β-hydroxyprogesterone is not a major intermediary in the formation of these corticoids from progesterone.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The second aspect of this study was stimulated by observations of previous investigators that the responsivity of adrenocortical tissue to ACTH in vitro is related to the structural integrity of the tissue preparation. To investigate this possible relationship, a preparation of bovine adrenal cortical tissue was devised which is intermediate in structural organization between homogenized and sliced tissue. This preparation, which consisted of small clumps of cells, was incubated under a variety of conditions and compared to similar studies carried out on adrenocortical slices. The corticosteroid production of these preparations was determined utilizing paper chromatographic techniques.

Evidence was obtained which indicated that certain cofactors and substrates which are necessary for corticoid formation were removed or destroyed in the preparation of these clumps of adrenocortical cells. Apparently as a consequence of this loss, the tissue no longer produced corticoids in significant amounts. However, corticosteroidogenic capabilities were restored in the presence of glucose by the addition of adenosine triphosphate (ATP), diphosphopyridine nucleotide (DPN) and fumarate to the incubation medium. Each of these cofactors contributed to the maximal corticosteroidogenic response, and ATP and DPN could be replaced by triphosphopyridine nucleotide (TPN). This cell-clump preparation did not respond to the ACTH either in the presence or absence of cofactor-fumarate supplementation. In contrast, adrenal cortical slices were shown to respond both to cofactor-fumarate supplementation and to ACTH; however, these effects were not additive. These results indicate that cofactor availability is rate-limiting in the process of corticosteroidogenesis, and are consistent with the concept that the mechanism by which ACTH stimulates corticosteroidogenesis may in some manner be concerned with an increased supply of cofactors to specific localized sites of enzyme activity within adrenocortical cells.

Microfilm $2.00; Xerox $6.20. 130 pages.

EFFECTS OF DIETS HIGH IN MEAT PROTEIN ON NITROGEN METABOLISM IN THE ADULT MALE

(L. C. Card No. Mic 58-5414)

Vincent Fiorica, Ph.D.
University of Illinois, 1958

A survey of the pertinent literature has indicated that a storage of nitrogen is able to be effected under optimal conditions of nitrogen and caloric intake. In order to investigate this phenomenon further, a series of three experiments were planned by means of which certain aspects of the nitrogen metabolism in the adult human male could be explored in relation to the level of nitrogen in the diet. The aspects of nitrogen metabolism which were selected for study were 1) the nitrogen excretion pattern, 2) the plasma nitrogen levels and 3) the nitrogen retention.

The experimental basal diet was selected to furnish approximately 4.8 grams of nitrogen per day at an energy level of approximately 2275 Calories per day. This diet was composed entirely of table foods selected for variety and for ease and accuracy of preparation and consumption. From this basal diet the meat-supplemented diets were prepared by the addition of appropriate amounts of lean ground beef. Whenever meat was added to the basal diet a quantity of oil or fat was removed calorically equivalent to the energy value of the meat added. In this manner all dietary regimes were maintained isocaloric.

The plan of each of the three experiments was identical. Three adult male subjects were placed on the basal diet for a period of eight days. Following this low-nitrogen period the subjects were then allowed the meat-supplemented regimen for 28 days. At the end of the meat-supplemented phase the low-nitrogen basal diet was again allowed for another period of eight days. The nitrogen levels of the diet during the meat-supplemented periods of each experiment were 11.9, 15.8 and 19.4 grams per day, respectively. These nitrogen levels were furnished by the addition to the basal diet of one-half, three-quarters and one pound lean ground beef per day.

During each of the experiments urine was collected daily from each of the subjects in 24 hour samples while feces were collected in pools of seven or eight days, each separated by the use of carmine markers. In addition, blood samples were taken from each subject before and after changes were made in the nitrogen intake. In order to determine the immediate effect of changes in nitrogen intake on the blood levels of nitrogen, samples were taken to represent the three days before and the four days following the transition in dietary nitrogen. All blood samples were taken from subjects in the post-absorptive state.

Samples of daily urine were subsequently analyzed for total nitrogen, urea, creatine, creatinine and uric acid. Fecal samples were analyzed for total nitrogen and blood plasma was analyzed for total nitrogen, non-protein nitrogen and urea.

As a result of these experiments, it was observed that after a sudden change in the level of dietary nitrogen a urinary excretion lag was evident which persisted for three to five days beyond the change in nitrogen intake. Following this lag phase total nitrogen excretion attained a level determined by the nitrogen intake. This change in total nitrogen excretion is apparently a reflection of the urinary urea nitrogen excretion since, in all subjects during each of the three experiments, the creatine, creatinine and uric acid nitrogen excretion was maintained relatively constant. Fecal nitrogen also was maintained relatively stabilized in each subject during the three experiments.

During the periods of increase in dietary nitrogen, plasma levels of non-protein and urea nitrogen were also observed to increase. This increase in the plasma non-protein nitrogen was paralleled by a simultaneous increase in urinary urea and total nitrogen excretion. In contrast to these plasma non-protein nitrogen increases, plasma protein varied but little as a result of the several levels of nitrogen intake.

The level of dietary nitrogen bears a direct influence on the total amount of nitrogen retained during the lag phase and during the whole of the meat-supplemented periods in each subject. However, the absolute amount of nitrogen retained by each subject during each of the three experiments appears to be a characteristic of the individual.

Microfilm $2.55; Xerox $9.00. 196 pages.

REPRODUCTION IN THE YEARLING EWE AS AFFECTED BY BREED AND SEQUENCE OF FEEDING LEVELS

(L. C. Card No. Mic 58-5339)

Warren Christopher Foote, Ph.D.
The University of Wisconsin, 1958

Supervisors: Professor L. E. Casida and
Professor A. L. Pope

This study was designed to examine the effects of the difference between two breeds, two systems of mating and two different levels of feeding on reproductive phenomena of sheep.

Ovulation rate, embryo survival and fetal development were studied at slaughter in 128 yearling ewes of mixed breeding in 1955 and in 330 grade Hampshire and grade Columbia ewes in 1956 and 1957 combined. Fetal development was studied at 40 days of gestation in the first year and at 25 and 140 days in each of the last two years. Straight-bred and reciprocal cross-bred fetuses were produced by mating purebred Hampshire and Columbia rams to the grade Hampshire and Columbia ewes. The ewes in each year were subjected to various sequences of feeding of grass-alfalfa hay and of the same hay plus grain (full and limited levels of feeding respectively) from the beginning of the experiment in mid-winter until they were slaughtered. Breeding was begun in October.

Those animals that were better grown out as indicated by greater body weight shed the greater number of ova in each of the three years. This was true whether variation in body weight was that which existed between ewes within the breed-feed sub-groups or whether it was produced by long time differences in feeding levels. Flushing (full feeding for approximately three weeks prior to breeding) increased ovulation rate in 1957 only. No appreciable increase in body weight was shown, in which case the temporary improvement in the nutritive state of the animals appears responsible.

Virtually all of the prenatal deaths appeared to occur by 25 days after breeding. Full feeding was detrimental to embryo survival in one out of the three years.

Full fed ewes showed greater somatic maturity as indicated by carcass weight, finish grade, carcass length and shin bone circumference than limited fed ewes. These levels of feed had no consistent significant effect on fetal development at any of the stages studied.

Fetal development at 140 days was measured in terms of fetus weight, fetus length, head length and width, shin bone length and circumference, hip width, area of eye muscle, kidney weight and liver weight. There was no evidence of a differential effect due to feed in these different tissues or organs.

Variations in the individual carcass measurements of the ewes were associated with variations in fetal development at 140 days. The ewes with longer carcasses (indicating greater development) produced heavier fetuses while those with higher finish grades (indicating greater fatness) produced smaller fetuses. This relationship did not exist at either 25 or 40 days of gestation.

Significant increases in maternal cotyledon weight due to changes from full to limited feeding were found at 40 days. Similar changes in fetal cotyledon weight at 140 days were noted due to limited feeding in the late part of gestation. The increased amounts of these tissues may have acted to obtain a greater nutrient supply from the mother thus protecting the fetus against a nutrient shortage imposed by limited feeding of the mother.

The Columbia dams provided a better maternal environment than the Hampshire. This accounted almost entirely for increased embryo survival in the Columbia dams whether carrying straight-bred or crossbred embryos. The additive genetic contribution of the Hampshire parents, however, produced larger fetuses than that of the Columbia. Again the fetal environment was in favor of the Columbia which had a cancelling effect on the additive contribution. The net effect for breed of dam for various characteristics tended toward zero.

Fetal membrane weight and fetal fluid weight at 25 days of gestation were significantly associated with fetus weight. The weight of the developing maternal cotyledons was significantly associated with fetus weight, independent of fetal membrane and fetal fluid weight at 40 days. At 140 days of gestation cotyledon weight had a significant direct effect on fetus weight which was greater than its indirect effect through fetal membrane weight. This was true for variation between single fetuses as well as between twin pairs of fetuses.

Within the limits of the variations in feed levels and breeds considered in this study ovulation rate appeared to be affected most by the former and embryo survival and fetal growth by the latter.

Microfilm $2.00; Xerox $5.80. 118 pages.

VENTRICULAR OXYGEN CONSUMPTION AS INFLUENCED BY MYOCARDIAL FIBER LENGTH AND TENSION IN THE RAT

(L. C. Card No. Mic 58-3106)

Eugene Alfred Lentini, Ph.D.
Boston University Graduate School, 1958

Major Professor: Earl R. Loew, Ph.D.

Experimental investigations were undertaken to determine the effects of fiber length, resting tension, isotonic contraction and isometric developed tension on the myocardial oxygen consumption. The tissue under study was a trabecula carneae from the left ventricle of rat heart. The metabolic studies were carried out in two different Warburg manometric systems.

In a stationary manometric system, which permitted the simultaneous measurement of oxygen consumption, resting and developed tension, and also fiber length, the influence of both resting tension and fiber length was determined in respect to the oxygen consumption of non-stimulated preparations. Another experiment was performed in the same system on muscles stimulated to contract isometrically at a frequency of one per second. Developed tensions at various resting tensions were recorded and related to the respiratory activity of the muscles.

In a standard oscillating Warburg system, muscles were placed under the same resting tensions as in the stationary manometric system. The resting tensions were imposed on the muscles by suspending weights from one

end. The oxygen consumption of muscle columns was determined during a non-stimulated and stimulated interval. During the period of stimulation, the muscles were stimulated to contract isotonically sixty times per minute. The lengths of the muscles with and without the attached weights were measured.

It was found that stretching muscles to various lengths under the specified tensions did not uniformly influence the oxygen consumption. It was also found that the oxygen consumption of non-stimulated muscles was statistically identical to that of muscles stimulated to contract isotonically. However, non-stimulated muscles with known weights attached to one end and swaying in unison with the oscillations of the Warburg shaker, showed a relationship between magnitude of attached weight and respiratory activity. In this group of muscles, it was found that the respiration at a 1.0 gram resting tension was significantly higher than at a 0.5 gram resting tension. A statistical decrease in QO_2 was noted from a resting tension of 1.0 gram to 2.0 grams. An explanation for this variation in respiratory activity is presented. Suggestive evidence was obtained to indicate that an inverse hyperbolic relationship existed between muscle QO_2 and peak developed tension.

It was concluded that:

(1) Myocardial oxygen consumption is not a function of fiber tension, per se.

(2) Myocardial oxygen consumption is not a function of fiber length, per se.

(3) The oxygen consumptions of non-stimulated and stimulated heart muscles contracting isotonically at one per second do not differ statistically.

(4) The myocardial oxygen consumption of isometrically contracting muscle is not a function of the resting tension or fiber length.

Suggestive evidence was obtained to indicate that the myocardial oxygen consumption may be influenced by continual variations in fiber length and tension, and that the peak developed isometric muscle tension bears an inverse hyperbolic relationship to the muscle oxygen consumption.

Microfilm $2.00; Xerox $4.60. 89 pages.

THE EFFECT OF GLUCOSE AND ITP ON THE SEASONAL VARIATION OF GASTRIC ACID SECRETION IN RANA PIPIENS

(L. C. Card No. Mic 58-5460)

Sherwin Mizell, Ph.D.
University of Illinois, 1958

Reports in the literature state that in the frog there is a seasonal variation in blood sugar, liver glycogen, and fat bodies. These changes can be related to cyclic changes in activity patterns. Previous studies on gastric acid production established a seasonal cycle which seemed to correlate with cyclic changes in blood sugar levels reported in the literature. Since HCl production in the stomach is a secretory process which requires energy, the availability of which varies from season to season, the hypothesis was tested that acid production could be made uniform throughout the year if sufficient substrate was presented to the membrane.

The in vitro production of gastric acid by Rana pipiens, which had previously been maintained at 21°C. for a minimum of 14 days was studied. The mucosal membranes were mounted in a two-chambered apparatus with frog Ringer's + histamine on the nutrient side and saline on the secretory side of the mucosa. Through a period of 13 months the gastric HCl production (at 21°C) was investigated using 383 frogs which were divided into 4 groups. The control group had only histamine added to the nutrient chamber. The other three had either 10 mM glucose, 0.6 μM inosine triphosphate or a combination of both added to the nutrient chamber in conjunction with the stimulant, histamine. For each mucosa ΔpH, titrable acidity, total chloride and total mucus produced was determined.

The control group of animals exhibited a seasonal variation in acid production with peaks in late spring and in late fall and lower values for the other seasons. This cycle in gastric HCl secretion duplicates the results found in our previous study conducted at 4°C. and 27°C. and substantiates our hypothesis that the seasonal cycle of acid production in the frog is independent of environmental temperature.

The addition of inosine triphosphate had no effect on acid production. However, the addition of 10 mM glucose to the nutrient chamber increased acid production to a level which was constant throughout the year and statistically different from the control group during all seasons. This increased level of acid production was not found to vary by changing the concentration of added glucose between 3 and 16 mM. Also, regardless of the amount of glucose added, a constant amount had disappeared from the nutrient solution after acid was produced by the mucosa.

Experiments also showed that the glycogen content of the mucosal membrane varied from month to month. An increase in glycogen content was found from February to March to April. The glycogen content of the mucosa decreased after acid was secreted.

Mucus production did not vary regardless of substrate or season. However, when compared on a monthly basis, February was statistically higher and May was lower than the constant value in mucus production observed during the other months.

The results obtained for glucose and glycogen utilization are taken as evidence that the seasonal variation in gastric acid production in the frog is due, at least in part, to a variation in substrate availability. The relationship of the endocrine glands to this variation in substrate availability and the possible existence of a two-part mechanism for the control of acid production in the gastric mucosa is considered.

Microfilm $2.00; Xerox $4.00. 71 pages.

POLITICAL SCIENCE, GENERAL

JUDICIAL INDEPENDENCE AND THE SUMMARY CONTEMPT POWER OVER PUBLICATIONS

(L. C. Card No. Mic 58-5361)

Ernest Elmer Means, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor David Fellman

This study seeks to focus a relatively intensive inquiry upon an abrupt change in public policy which was brought about by two decisions handed down by the Supreme Court of the United States in 1940 and 1941. The circumstances of these decisions--Nye v. United States and Bridges v. California--compel the conclusion that their practical consequence was virtually to terminate the historic power of both state and federal courts to punish for contempt of court the authors or publishers of publications held to obstruct the administration of justice. The importance of the change has been attested to by the frequent protestations by both state and federal judges, by some commentators, and by a minority of the Justices of the Supreme Court itself, that this power is vitally necessary to the proper performance of the judicial function. Because, however, the efficacy of the contempt power to preserve judicial independence was thought not to be objectively demonstrable, it was assumed for the purpose of the present study.

Through the analysis of relevant published decisions of both state and federal courts, the study has sought answers to the following questions: (1) What was the status of the summary contempt power over publications when the Court handed down its 1940-41 decisions? (2) Were the decisions in these cases demanded by any logic in the situations presented or by any compelling line of precedent? (3) Is the public policy contained in these decisions a desirable one in the premises? and (4) Can a more desirable policy be suggested?

Analysis of the cases and literature dealing with the subject suggested the following answers to the foregoing:

1. Up to 1940-41 and the decisions adverted to, the contempt power over publications had remained a viable instrument for the preservation of judicial independence, in the sense that judges had retained most of their discretion as to the time and manner of its application.

2. Analysis of the underlying theories of the two decisions, as well as of the two major contributing concepts of "clear and present danger" and "judicial fortitude," suggests that niether decision was demanded either by the logic of the respective situations or by the relevant precedents. Both were taken to represent deliberate policy-making on the part of the respective majority Justices.

3. On the basis of a critical analysis of the most frequently encountered objections to the summary contempt power, it was concluded that the Court acted precipitously in striking down this historic instrument for the preservation of judicial independence. The objections treated consisted of the notions that judges should have no greater protection against popular criticism than is accorded non-judicial public officials; that there are satisfactory alternatives to the summary contempt power that are less repressive to human freedom; and that such an arbitrary power is too susceptible to judicial abuse.

4. The infinite variability that the conflict between freedom of speech and judicial independence may take suggests that the real problem is not that of attempting to draw a line between them, but, rather, of delegating the power to decide to that organ that can provide the greatest flexibility in making the necessary adjustments between them. The only possible place to make this delegation is to the courts themselves, subject to the safeguards provided by the traditional judicial processes, including regular appellate review.

In short, then, it is the basic conclusion of the present study that the Supreme Court erred in striking down the judicial power to punish obstructive publications, and that it would do well to consider restoring this instrument to its pre-1940 status.

Microfilm $5.40; Xerox $19.20. 424 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

PSYCHOLOGY, GENERAL

A STUDY OF JUDGMENT OF TIME INTERVALS IN MIXED-RACIAL GROUPS

(L. C. Card No. Mic 58-3489)

Willis Carpenter Driscoll, Ph.D.
The University of Florida, 1958

The present study has attempted to ascertain the effect of appearance in racially homogeneous and heterogeneous groups on the judgment of time intervals by Negroes and Whites. Twenty-four subjects of each race were recruited from the Janitorial and Plants and Grounds staffs of the University of Florida. Each of the subjects made ten judgments of three time intervals, 5, 10, and 30 seconds in seven different settings. These settings were alone, in groups of two of each race, with two members of his race and one of the other race, and with three members of the other race. Design of the experiment required that each subject appear three times in groups composed of two other members of the same race and one member of the other race.

Procedurally, subjects were asked to wait the stated number of seconds after the experimenter had quit sounding a buzzer and then to press a key before them. The key was wired to an electromagnet which operated a pen. The pen marked on paper operated by a kymograph. The paper thus recorded cessation of the stimulus and the responses of all subjects.

No significant groups results were found in regard to the two races, the five different experimental situations. or the interaction between the two.

Analysis of variance in three settings, alone, in racially homogeneous groups, and racially heterogeneous groups, again revealed no group differences in the precision of time perception.

Complex analysis of variance was then undertaken, using all 7200 judgments, with ten judgments to each cell. Here again differences among experimental situations were not found. However, individuals did differ in their overall judgment of time intervals. Finally and of greatest importance in this study, despite the absence of significant interaction between race and experimental situation, interaction between individuals and experimental setting was found to be significantly greater than would be expected on the basis of chance. Judgments of individuals are very strongly influenced by group pressures in racially mixed groups. This influence is highly individual and does not differentiate between races as total groups.

From these findings we may conclude that the various group compositions utilized in this study do significantly affect the judgment of time intervals by individual subjects.

Microfilm $2.00; Xerox $3.00. 40 pages.

A STUDY OF EFFECTS OF BALANCE UPON THE PERCEPTION OF SOCIAL SITUATIONS

(L. C. Card No. Mic 58-3911)

Jack Isaac Esterson, Ph.D.
The University of Connecticut, 1958

Heider has proposed that social events tend to be perceived by a person, p, as balanced cognitive units in which another person, o, and an act, x, attributed to o are evaluated similarly. When a discrepancy exists between p's evaluation of o and of x, one of the following types of changes within the cognitive unit tends to occur: a) the evaluation of o alters to agree with the evaluation of x; b) the evaluation of x alters to agree with the evaluation of o; c) o is no longer seen in a unit-relationship with x. In this study, the unit-relationship was defined in terms of o's responsibility for x.

The major purpose of the present study was to determine more precisely the nature and extent of each type of change as o and x varied in degree of similarity of their social benefit, i.e.: the degree of change in o's benefit, the degree of change in x's benefit, and the degree of change in the perceived responsibility of o for x.

Changes in the evaluation of o and x were studied by means of ratings of sentence-situations, describing o and x in terms of prerated occupational roles and acts, established along a social benefit-harm continuum. S rated the sentences presented to him for the following: a) the benefit of o to others, b) the benefit of x to others, and c) o's responsibility for x. The roles and acts used in this study were selected from five representative points of previously established benefit-harm continua for roles and acts, respectively.

Changes in the evaluation of o were studied as acts of varying degrees of benefit and harm were attributed to o. In a like manner, changes in the evaluation of x were studied as the similarity in benefit of o to x was varied. Responsibility ratings obtained in each test situation were studied as well.

Each of 48 S s judged five different role-act situations. The situations presented to S were selected at random from the 64 role-act combinations used in the study with the restriction that no role or act appear in more than one situation.

The following are the main results drawn from statistical analyses of ratings of persons, acts, and attributed responsibility:

1. Overall, persons and acts, with respect to their social benefit, tend to be rated as balanced units, or in unbalanced relationships with o not responsible for x. Deviations from these findings indicate an underlying optimism in S's evaluations:
   a. Unbalanced units involving a harmful o with a beneficial x are more likely to be formed than unbalanced units involving a beneficial o with a harmful x.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

b. Balanced relationships in which o is not responsible for x are more likely when o and x are harmful than when they are beneficial.

2. The evaluation of o progressively alters in the direction of the combining x, as x becomes progressively incongruent with o.

3. An x of extreme benefit or harm tends to be rated independently of the doer. However, xs of less than maximal benefit or harm are evaluated consistent with the benefit or harm of the doer.

4. A progressive decrease in o's responsibility for x occurs when o is beneficial and x is increasingly harmful; the more beneficial is x, the less is his responsibility for a harmful o. When o is harmful, he is rated as responsible for his beneficial acts as he is for his harmful ones.

Further research using "live" situations and other populations is required to determine the generality of the findings. The results were shown to have applicability in understanding how evaluations of mental patients or prisoners might be altered when beneficial or harmful acts are attributed to them. Microfilm $2.00; Xerox $6.20. 130 pages.

YIELDING BEHAVIOR OF DELINQUENT AND NON-DELINQUENT ADOLESCENTS

(L. C. Card No. Mic 58-3152)

Kathleen B. Fitzhugh, Ph.D.
Purdue University, 1958

Major Professor: H. H. Remmers

The research was designed to study two major problems. It was predicted: (1) that delinquent adolescents will exhibit greater yielding to simulated information that two different groups of adolescents had given a majority response contrary to their own; that delinquent boys will evidence greater yielding than delinquent girls; and that delinquents will yield more readily to a consensus attributed to the delinquent group than to that attributed to a non-delinquent group; and (2) hypotheses concerning the degree of dependence upon one's own age group of companions for approval and direction reported by delinquent subjects in contrast to non-delinquent subjects. Delinquent boys were predicted to evidence greater degrees of such dependence than delinquent girls; and non-delinquent girls greater degrees than the non-delinquent boys.

The subjects of the study consisted of two groups. Thirty-two girls and 35 boys residing in a disposition center for delinquent children composed the delinquent sample. Fifty-three boys and 46 girls in a public high school composed the non-delinquent sample. Subjects were selected so as to obtain groups roughly matched with regard to sex, age, color, and type of neighborhood of residence.

Two types of task were used in the study: (1) ambiguous figures for which varying degrees of pressure were exerted on the subjects to change their initial responses toward a consensus attributed to one or the other of two groups, and (2) a twenty-item list of sentences referred to as the Conformity Scale.

Delinquent subjects do not yield on the ambiguous figures task more than do the non-delinquents, but show significantly greater dependence upon their own groups of companions, as privately defined by the subjects, on the Conformity Scale. Delinquent girls, but not delinquent boys, show significantly greater tendency to yield to the non-delinquent consensus than to the delinquent consensus, suggesting greater readiness to agree with the non-delinquent group than the boys. Although the delinquents show a significantly greater tendency to depend upon their own groups of companions for approval and direction than do the non-delinquents, no sex differences in this trend are found for the delinquents. A significant sex difference is found for the non-delinquent subjects, in that the boys indicate greater dependence upon their own groups of companions than do the girls. Of all the groups, the non-delinquent girls indicate the least dependence upon their own groups of companions, as privately defined by the subjects. These findings are discussed in terms of the socio-economic strata represented by the groups, and the motivations for, and benefits derived from, group or gang membership within these strata.

Age does not correlate significantly with either of the two measures. Nor is a significant correlation obtained between the yielding measure and that of dependence upon one's own group of companions. The latter finding is discussed in terms of the apparent inefficiency of the yielding measure to differentiate between groups. The conclusion is drawn that the groups referred to specifically on the yielding measure were not as meaningful to the subjects as those defined as their reference groups when the definition was left to the subjects, as was the case in the Conformity Scale items. Suggestions are made with reference to improving the experimental situation so that yielding behavior in that situation would be more representational of yielding behavior in everyday situations.

From this study, it is concluded that further investigation of delinquent youngsters' dependence upon their own groups of companions might well be a profitable undertaking. Microfilm $2.00; Xerox $4.00. 71 pages.

A VALIDATION STUDY OF THE ACTIVITY VECTOR ANALYSIS

(L. C. Card No. Mic 58-3162)

Charles Howard Hammer, Ph.D.
Purdue University, 1958

Major Professor: H. H. Remmers

The Activity Vector Analysis is a personality test designed for use in industry. The test purports to yield behavioral information which is used to help make decisions with respect to the selection and placement of industrial personnel.

The purpose of this study was to test the extent to which interpretations of the Activity Vector Analysis provided a basis for making behavioral predictions. The criterion was "buddy" evaluations based on inferences from social contact.

The test was administered to a sample of 52 university students. Each student also filled out a biographical

inventory. Fourteen tests were rejected on the basis that the profiles were too "tight" to be interpreted. The remaining 38 AVA's were interpreted by three AVA analysts, two of whom were also Ph.D. clinical psychologists. Analyst 1 interpreted 38 tests, Analyst 2 interpreted 23 tests, and Analyst 3, who had had no graduate training interpreted 15 tests. Each analyst then evaluated, by means of a Q-Sort of descriptive statements, those subjects whose tests he had interpreted.

The same descriptive statements were also Q-Sorted by three graduate students in psychology on the basis of biographical information, and by "buddies" on the basis of inferences from social contact.

The average inter-analyst reliability is .677. The average correlations between the analysts' Q-Sorts and the averaged "buddy" sorts are .402 (significant at the .01 one-tailed level), .393 (significant at the .01 one-tailed level), and .193 (significant at the .05 one-tailed level) for Analysts 1, 2, and 3 respectively. There is also a significant difference between the average correlation of Analyst 1 (r = .317) and the average correlation of Analyst 3 (r = .193), who is not a clinical psychologist, over the same subjects.

The average correlation between the averaged biographical sorts and the averaged "buddy" sorts is .535.

The average correlations between the analysts' Q-Sorts and the averaged biographical sorts are .304 (significant at the .01 one-tailed level), .300 (significant at the .01 one-tailed level) for Analysts 1, 2, and 3, respectively.

A single sample "t" test over the same set of averaged "buddy" sorts for the difference between the average correlation of sorts for Analyst 1 (r = .402) and the average correlation of the biographical sorts (r = .570) is significant at the .01 level.

The results of this study support the following generalizations:

1. Information elicited from AVA interpretations provides a basis on which to make behavioral predictions.
2. Information elicited from interpretations of a biographical inventory provides a basis on which to make behavioral predictions.
3. The biographical inventory appears to elicit a significantly greater amount of behavioral information than the AVA.
4. There is a significant relationship between information elicited from AVA interpretations and information elicited from interpretations of a biographical inventory.
5. Education and experience in clinical psychology, in addition to that gained in AVA analyst training programs, may have a significant effect on the ability of analysts to interpret the AVA.
6. Caution should be used in generalizing the results of this study from a college sample to an industrial sample.

Microfilm $2.00; Xerox $4.20. 78 pages.

THE INFLUENCE OF IMMEDIATE AND DELAYED INFORMATION ON HUMAN MAZE LEARNING AND TRANSFER

(L. C. Card No. Mic 58-3496)

Thomas G. Kemp, Ph.D.
The University of Florida, 1958

The purpose of this study was to investigate the relative influence of immediate and delayed guidance, in the form of information, and of different amounts of guidance on human maze learning and transfer. In so doing we assumed that guidance given at critical times during learning may serve to interfere with the acquisition of the essential elements to be learned. While guidance given some time after these crucial points might more likely serve to facilitate the differentiation and retention of the cues necessary for the learning. It was felt that the influence of the different methods would extend over into a transfer situation in which no guidance was given.

One hundred and eighty college students, male and female, with a mean age of 24 years, and naive as to maze learning served as subjects. Each subject was randomly assigned to one of eleven groups, known as Groups I, D, C, I-5, D-5, VI, and VII. There were thirty subjects in each of the first five groups and fifteen in the last two groups. Metal plates embedded in the floor of a standard ten-turn Warden U-type maze at specific points served to mechanically operate red and green signal lights when the subject touched them with the stylus. The maze was hidden, but the lights were visible to the subjects. The lights for Group I operated just as the subject made his turn at each choice-point and for Group D they operated just prior to the next turn following each choice; red indicated an incorrect turn and green a correct turn. Group C received no guidance, Group I-5 received five trials of immediate, Group D-5 five trials of delayed guidance. All of these groups received 15 training trials. Groups VI and VII received similar amounts of both forms of guidance in a counterbalanced order for 20 trials. They were also asked to indicate a preference, if any, for a type of guidance. No guidance was given on the transfer (lateral reversal of the training maze) maze, which all subjects ran to a one errorless trial criterion.

Analysis of variance indicated significant between group variability of errors on the training maze as a result of the different modes of guidance. Significant t's supported the prediction favoring delayed guidance, immediate guidance, and no guidance, respectively, during training. Significantly more subjects in Group D than in Group I made one errorless run during training. The influence of delayed guidance was found in the significantly better performance of Group D over Group C on the transfer maze. Small amounts of guidance did not prove more efficacious than large amounts. There was only a slightly greater preference for delayed over immediate guidance reported.

Although delayed guidance proved more efficacious than immediate guidance, this does not permit us to say how it operated in enhancing learning. Our results do not agree with the notion of guidance as enhancing only anticipative goal oriented behavior. It is speculated that guidance, in the form of information, may serve man who, in retrospect, is capable of unlearning and relearning. Further, more analytic research is suggested.

Microfilm $2.00; Xerox $3.00. 51 pages.

THE AUCTION VALUES OF UNCERTAIN OUTCOMES IN WIN AND LOSS TYPE SITUATIONS

(L. C. Card No. Mic 58-3107)

Bernhardt Lieberman, Ph.D.
Boston University Graduate School, 1958

Major Professor: Associate Professor Philip Nogee

The three studies that are reported in this dissertation compare human behavior with the normative behavior called for by the following expected value model:

$$EV = pR + (1-p)L, \quad \text{where}$$

EV = expected value, p = probability of winning, R = amount of reward, (1p) = probability of loss, and L = amount of loss.

The deviations from the model, when rationalized, give information about decision making in risky situations. The studies grew out of an experiment by Preston and Baratta (American Journal of Psychology, 1948) which indicated that individuals overestimate the likelihood of the occurrence of an event when its probability of occurrence is 0.01 and 0.05 and underestimate the likelihood of an event with probabilities ranging from 0.25 to 0.99.

The concept of psychological or subjective probability was used to make the behavior studied more meaningful. Psychological probabilities are those subjective values, derived from observations of behavior, corresponding to the objective probability values which range from 0 to 1.

The first study done consisted of a replication of the Preston and Baratta work, using normal and schizophrenic subjects. This study gave information about behavior in a win type situation. The second study gave information about behavior in a risky situation in which the subject was given another person's probability of winning. To conform to the expected value model the subjects had to complete a (1-p) estimation process. The third study yielded information about behavior in a loss type situation.

Data from the three studies gave information about the question of the summation of psychological probabilities whose corresponding objective probabilities sum to 1.

A total of 40 subjects, 40 normals and 40 schizophrenics participated in the studies. The schizophrenics were hospitalized veterans and the normals were psychiatric aides employed at a Veterans Administration Hospital. The subjects played three experimental dice games, using play money, for prizes consisting of cigarettes and candy. Measures of intellectual and arithmetic ability were administered to the subjects.

The results of the three studies indicated that both normals and schizophrenics are capable of making numerous and somewhat complex expected value estimations. In general the behavior of subjects follows the expected value model, however, certain systematic deviations from the rational model occurred in each study.

In the first study, the previous underestimation, overestimation findings were confirmed: both schizophrenics and normals overbid at probability values 0.01 and 0.05 and underbid at objective probability values ranging from 0.25 to 0.99.

In the second study similar effects were found. Where the subjects' likelihood of winning was 0.01 and 0.05, overestimation occurred: where their likelihood of winning ranged from 0.25 to 0.99 underestimation occurred.

In the third study, the loss type situation, underestimation occurred for probabilities of loss of 0.25, 0.50, 0.95 and 0.99. The data appear to indicate that subjects tend to overestimate the likelihood of loss very slightly at p = 0.75.

Comparison of the behavior in win and loss type situations, both for normals and schizophrenics, indicates that behavior conforms more closely to the expected value model in a loss type situation than a win situation.

When psychological probabilities were summed underestimation of the rational model was the general finding. In general, the deviations from the rational model were greater for schizophrenics than for normals.

Microfilm $2.15; Xerox $7.60. 164 pages.

A CONFIGURAL VERSUS THE STANDARD METHOD OF SCORING THE STRONG VOCATIONAL INTEREST BLANK

(L. C. Card No. Mic 58-5450)

Robert Lincoln Malone, Ph.D.
University of Illinois, 1958

A configural method, McQuitty's Similarity Analysis, was compared with the standard method of scoring the Strong Vocational Interest Blank (SVIB).

The research hypothesis was that the use of a configural or pattern-analytic method, Similarity Analysis, which can classify individuals into subgroups in terms of similarity among their response patterns will provide more accurate prediction of occupational membership than do the scales produced with Strong's keys.

Data and method:

The investigation utilized data obtained from Strong. A total of 350 S's, 50 in each of seven occupations, was used for developing scoring keys for Similarity Analysis, and an additional 350 S's, or 50 in each occupations, were used for determining the relative discriminating power of the two methods. The occupations were Artist, Engineer, Forest Service Man, Musician, Accountant, Life Insurance Salesman, and Lawyer.

For each occupation, two or more Similarity Analysis scoring keys were derived by classifying 50 standardization individuals into relatively homogeneous subgroups on the basis of agreement existing among their response patterns on the 400 items of the SVIB. A scoring key for each subgroup was defined as the proportion of individuals in the subgroup who endorse each item-alternative. Using ILLIAC, the University of Illinois electronic digital computer, 350 cross-validation S's were scored on 39 Similarity Analysis keys. The scores of the 16 larger keys were compared with those provided by the standard method. A Similarity Analysis prediction of occupational membership was made for each cross-validation S. The prediction was defined as the occupational subgroup key on which the S obtained his highest score. The SVIB prediction of occupational membership was based on the occupational key on which he obtained his highest standard (relative) score.

Each method's discrimination of the seven occupations was evaluated by comparing predicted membership with actual membership which was known in advance.

Results

1. The Similarity Analysis keys provided discrimination of the 350 cross-validation S's which was significant

beyond the .001 level. The significance of the Life Insurance keys was based on a greater risk in that one expected frequency was less than five.

2. The seven SVIB keys yielded discrimination which was significant beyond the .001 level for all seven occupations.

Inspection of the results indicated that the discriminating power of the latter method tended to be superior to that of Similarity Analysis for each occupation.

3. The discriminating power of the 16 larger Similarity Analysis keys was superior to that of all 39 keys so that inclusion of the 23 smaller keys, which were based on but one to three individuals each, did not improve discrimination.

4. Attempts to investigate the stability of subgroups for different samples of items and different samples of persons yielded non-significant results in that some of the subgroups for respective samples were not of sufficient size to permit the application of Chi-square.

5. Crude estimates of shrinkage were made, considering (a) median scores, and (b) the number of individuals scoring highest on each key. Only two keys appeared to change substantially in these respects. However, some question exists regarding the appropriateness of comparing medians since the score-distributions may be bi-modal or multi-modal in form.

Two considerations existed for the investigation which may have served to place Similarity Analysis in a less favorable light:

1. The Similarity Analysis keys were developed on N's of 35 or less per subgroup.

2. The data were not entirely independent of the original criterion groups used for developing Strong's keys.

The results were discussed in terms of methodological considerations involved in the further application of Similarity Analysis.

Microfilm $2.00; Xerox $5.60. 115 pages.

ATTITUDES AND CONCEPTS OF PUERTO RICAN PROFESSIONALS REGARDING MENTAL ILLNESS: AN EXPLORATORY STUDY OF A GROUP OF PUERTO RICAN PROFESSIONALS; MEDICAL DOCTORS, SOCIAL WORKERS, NURSES, TEACHERS, AND RELIGIOUS WORKERS

(L. C. Card No. Mic 58-1991)

Juan N. Martinez, Ph.D.
New York University, 1958

Chairman: Professor H. Harry Giles

The purpose of this study was to examine and compare the attitudes and concepts regarding mental illness on the part of various professional groups in Puerto Rico: medical doctors, social workers, teachers, nurses, and religious workers. It also was designed to compare the relative influence of professional training and cultural factors influencing those attitudes.

It was conducted through a questionnaire consisting of six parts, namely: general concepts regarding mental illness, attitudes towards causes of mental illness, general attitudes towards mental illness itself, attitudes towards the mentally ill who recover and return to society, attitudes towards the methods used in the treatment of the mentally ill, and attitudes towards the psychiatrist.

The questionnaire was sent by mail to one thousand respondents chosen at random from the lists of the professional organizations of the five professional groups studied. Six hundred and thirteen persons answered.

Each subject's answers were checked against a master list of "desirable" and "undesirable" answers previously determined in consultation with authorities in the field of attitudes, mental hygiene and abnormal psychology.

The attitude or general concept value for each person, for each part of the questionnaire, was determined. The subjects were grouped according to the three factors of training investigated: type (profession), amount (years in college), and place (place of training).

The analysis of the evidence seems to back the contention that cultural forces reflect themselves in the people's attitudes toward mental illness, toward causes, and toward rehabilitated patients returning to normal life. The data appear to justify the assumption that in these three cases, cultural factors are stronger influences than professional training.

The existence of concepts related to mental illness, as revealed by the present study, indicate that they are in harmony to a great extent with the professionalized preparation and training the subjects have received. In other words, manifest concepts tend to agree with the best knowledge man has been able to obtain from the study of mental illness.

However, when prevailing concepts among subjects are compared with their attitudes toward mental illness, its causes, and their attitudes toward recovered patients, a significant difference is observed, which may lead to the conclusion that the verbalized ideas of the subjects studied do not correspond, generally speaking, to their beliefs and attitudes. The discrepancy between concepts and attitudes in this respect seems to point toward the greater influence of professionalized knowledge in the case of the concepts and toward a greater influence of cultural forces in the case of the attitudes.

Microfilm $2.00; Xerox $5.00. 98 pages.

THE EFFECTS OF EXPERIMENTALLY INTRODUCED ANCHORAGES UPON JUDGMENTS IN THE AUTOKINETIC SITUATION

(L. C. Card No. Mic 58-3882)

James Oliver Whittaker, Ph.D.
The University of Oklahoma, 1958

Major Professor: Muzafer Sherif, Ph.D.

The purpose of this study was to investigate some social factors which appear to be important in determining simple judgmental reactions in an unstructured stimulus situation. Specifically it was concerned with the effectiveness of various experimentally introduced anchorages in inducing shifts in judgment as a function of the distance or discrepancy between the established scale of judgment of the subject and the introduced anchorage. On the basis of a survey of relevant literature and pretest data, it was hypothesized

that there is an inverse relationship between judgmental shift and the discrepancy between the subject's judgmental scale and the introduced anchorage.

Fifty male, undergraduate subjects served in two experimental sessions in which they were asked to judge the apparent movement of a stationary point of light, the autokinetic phenomenon. Each subject made a series of judgments alone during the first session. Following the first session the subjects were divided into five groups of ten subjects each. Subjects in one of these groups (Condition A) served as a control group and made judgments in the second session under conditions identical with those in the first session. Subjects in the four experimental groups made judgments in the second session in the presence of a "plant" serving as a subject.

With subjects in one of the groups (Condition B) the median of the "plant's" judgments was set one inch above the largest judgment made by the subject in Session I. In another group, the median of the "plant's" judgments was approximately twice as large as the maximum judgment of the subject in Session I (Condition C). In the third experimental group, the "plant's" judgments were approximately eight times the subject's maximum estimate (Condition D). And in the remaining group, the median of the "plant's" judgments was approximately twelve times the subject's maximum judgment in Session I (Condition E).

The testing of the hypotheses required comparison of the distributions of judgment between Session I and Session II under the above five conditions. Two different methods of analysis were employed for these comparisons. 1- An analysis of covariance of change in norms between Sessions I and II. 2- Comparison of the number of judgments in the second session lying outside the range of judgments in the first session.

It was concluded that anchorages relatively close to the subject's norm (Conditions B and C) are substantially more effective in inducing shifts in judgments than anchorages which are more remote (Conditions D and E).

Suggestions were offered for extending the research design to study effects of complex or persuasive communications on actual attitudes. Theoretical implications of the findings for problems of attitude change were discussed.

Microfilm $2.00; Xerox $6.00. 125 pages.

PSYCHOLOGY, CLINICAL

PERCEPTUAL RIGIDITY: AN EXPERIMENT WITH THE RORSCHACH TEST AND THE AUTOKINETIC EFFECT

(L. C. Card No. Mic 58-3480)

Louis William Bova, Jr., Ph.D.
The University of Florida, 1958

The purpose of the study was to examine the relationship between two measures of rigidity: (1) a measure which may be derived from the perceptual response to the Rorschach test, and (2) a measure based on the perceptual response to the autokinetic phenomenon.

The specific hypotheses to be examined were:

1. Those subjects who express a greater amount of rigidity on the Rorschach test will perceive a correspondingly smaller amount of autokinetic movement.
2. Those subjects who express a greater amount of rigidity on the Rorschach test will show a correspondingly greater reaction time between the presentation of the autokinetic stimulus and the perception of movement.
3. Those subjects who express a greater amount of autokinetic movement will have a correspondingly shorter reaction time between the perception of the autokinetic stimulus and their perception of movement.

A normal sample composed of fifty white male college students, and a second sample of thirty-one brain damaged VA hospital patients were used as subjects. They were administered a Rorschach test and also placed in an autokinetic situation where they were to make a graphic record of the movement they perceived.

The Rorschach test protocols were scored for rigidity according to Fisher's technique and the recordings of the amount of movement perceived was measured to the nearest tenth of an inch. These data represented the degree of rigidity manifested by the subject in each situation and a Pearson product-moment correlation was used to establish the relationship. A t- test was also used to determine if a significant difference existed between the samples' rigidity scores, and the amount of autokinetic movement recorded.

The results failed to show a significant relationship between age and rigidity scores for both groups. They did reveal, however, a significant relationship between rigidity score and autokinetic movement, reaction time and rigidity score, and amount of autokinetic movement and reaction time, for the brain damaged sample, but only between reaction time and autokinetic movement for the normal sample. The differences between the two groups' rigidity scores, and autokinetic movement were also significant. Thus, it was concluded that quicker perception of movement is positively related to the amount of movement perceived, but that there is probably a critical minimum degree of rigidity necessary before there is a relationship shown between rigidity score and autokinetic movement.

Microfilm $2.00; Xerox $3.00. 33 pages.

THE RELATIONSHIP OF ANXIETY TO THE ASSOCIATIVE AND NONASSOCIATIVE ASPECTS OF SIMPLE AND COMPLEX LEARNING

(L. C. Card No. Mic 58-3962)

Richard Miles Bryant, Ph.D.
The University of Texas, 1958

Supervisor: Professor Philip Worchel

It was the purpose of this experiment to demonstrate the importance of associative as well as nonassociative factors in predicting differences in performance for high-anxious and low-anxious subjects in simple and complex

learning situations. Two scales were developed; one, referred to as the Drive scale, to measure nonassociative aspects and another, referred to as the Task-irrelevant scale, to measure the associative aspects present in a learning situation. A third variable, ego-involvement was added for the consideration of situational stress, by varying the instructions given to the subjects. It was predicted for simple learning that high-drive and ego-involved subjects would obtain significantly better learning scores and that there would be no significant difference between the learning scores of subjects scoring high and low on the task-irrelevant scale. For complex learning it was predicted that the low-drive subjects, the low-task-irrelevant subjects and the non-ego-involved subjects would obtain significantly better learning scores. A 2 x 2 x 2 experimental design with 64 subjects was used in this study. To form these groups 320 students were given the Drive and Task-irrelevant scales. The 183 male students, which comprised the larger of the two sex groups, were first divided into high and low groups on the basis of drive scores. These two groups were then subdivided into high and low groups on the basis of their task-irrelevant scores. Each of these four groups was further divided into two groups, one to be given ego-involved and one non-ego-involved instructions, by carefully matching the subjects' drive and task-irrelevant scores. The results indicated that:

1. The product-moment correlation between the Drive scale and the Taylor A-scale was .00 and between the Task-irrelevant scale and the A-scale was .80.

2. For simple learning none of the F-ratios for drive, task-irrelevancy, or ego involvement or for the interactions of these variables was significant on either the reaction time or the tapping measure.

3. For complex learning the F-ratio for drive was significant at the .05 level when the learning measure was maze-errors and maze-trials but was not significant for maze-time. None of the F-ratios for the other variables or for any of the interactions was significant.

On the basis of the A-scale's high correlation with the Task-irrelevant scale, which was limited through definition to associative factors, and its lack of correlation with the Drive scale, which was limited through definition to nonassociative factors, it was concluded that the A-scale does reflect associative tendencies and that therefore the A-scale predictions based on purely nonassociative assumptions may not be valid. The lack of significance for the task-irrelevant variable on complex learning suggest that task-irrelevancy is not an appropriate way to conceptualize the associative factors present in this study. That some type of associative factor does have a differential effect on high- and low-drive subjects on a complex learning task, even when the subjects are selected according to strictly nonassociative criteria, is suggested by a qualitative analysis of the data.

It appears that associative as well as nonassociative factors do play an important part in predicting performance difference for high-anxious and low-anxious groups in simple and complex learning and that this area is worthy of further exploration and experimentation.

Microfilm $2.00; Xerox $4.20. 76 pages.

RESPONSE TO HUMOR AS A FUNCTION OF DRIVE AROUSAL AND PSYCHOLOGICAL DEFENSES

(L. C. Card No. Mic 58-2502)

Donn Erwin Byrne, Ph.D.
Stanford University, 1958

This research was undertaken in order to test the hypothesis that drive strength is one antecedent condition which exerts a major influence on response to humor and that habitual psychological defense modes determine the specific nature of this influence. Response to humorous material was analyzed theoretically in terms of Hullian learning theory.

A review of the literature covering humor theory and research was presented as well as a summary of the relevant studies involving drive arousal, perceptual defense, and the relationship between fantasy and overt behavior.

The experimental subjects who served in the study were 76 male undergraduate students at Stanford University. These subjects were administered three tests which were developed by the experimenter for the purpose of assessing an individual's tendency to utilize either repressive or sensitizing defense mechanisms in dealing with sexual and hostile stimuli. The tests consisted of a Sentence Completion Test, a Multiple-Choice Thematic Apperception Test, and a Memory for Words Test. The subjects also rated themselves as to the frequency with which they engaged in various forms of sexual and aggressive behavior.

In a second session several weeks later, the subjects were divided into groups and subjected to one of several experimental conditions designed either to increase drive strength or as a control experience. The Sex Arousal Group read literary passages which were sexually exciting, and the Aggression Arousal Group took a "spatial concentration test" from a condescending, rude, antagonistic experimenter. Other groups were subjected to similar but nonarousing control conditions. Immediately afterward, each subject took a 64 item Humor Test which was made up of four groups of cartoons prejudged as depicting the expression of hostile impulses, the expression of sexual impulses, ridicule, and nonsense.

It was found that (1) funniness ratings of cartoons which depict the expression of sexual impulses were unrelated to defenses against sexual stimuli or to arousal of sex drive, (2) funniness ratings of cartoons which depict the expression of hostile impulses were unrelated to defenses against hostile stimuli or to arousal of aggression drive, and (3) funniness ratings of cartoons which depict subtle hostility in the form of ridicule were significantly related to defenses against hostile stimuli and to arousal of aggressive drive if the interaction effects of amount of aggression conflict and defenses against sexual stimuli were taken into consideration.

In addition, it was found that (1) the different measures of defense against sexual and hostile stimuli were positively interrelated, (2) the self-ratings of frequency of various forms of sexual and aggressive behavior were significantly related to one another both within and between drive areas, (3) the various measures of defense against sexual and hostile stimuli were unrelated to the self-ratings of frequency of expression of sexual and aggressive behavior, and (4) self-ratings of behavior were unrelated to response to humor.

It was concluded that the use of humor preferences as an aid to understanding personality is still only a research goal and not yet an accomplished fact.

Microfilm $2.85; Xerox $9.80. 217 pages.

CONFORMITY ANALYZED AND RELATED TO PERSONALITY

(L. C. Card No. Mic 58-5411)

Norman Solomon Endler, Ph.D.
University of Illinois, 1958

In this study the process of conformity was analyzed and the relationships between its underlying components and certain personality variables were investigated.

The design aimed to test the following hypotheses: (1) conformity is a function of the degree of social pressure; (2) there are three distinct factors in conforming behavior: compliance, role-taking congruence, and true conformity; (3) conformity is positively related to deference, affiliation, succorance, and abasement as measured by the Edwards Personal Preference Schedule (EPPS), authoritarianism, and acquiescence (response-set to agree) as measured by the Public Opinion Survey (POS), and conformity is negatively related to achievement, autonomy, dominance, and aggression as measured by the EPPS; and (4) the personality scores and profiles differ for independents, compliers, role-takers, and true conformers.

The EPPS and the POS were administered to a total of 126 Ss. Six weeks later the Ss responded to a conformity scale (consisting of perceptual and informational items) in four different sequential situations or phases. In Phases I and IV, the Ss were tested individually. In Phase II, the Ss were tested in a conformity apparatus in groups of five. They received simulated information about one another's responses to the items. This information was contrived by the experimenter with the aid of the apparatus. On the critical items, each S got the impression that each of the other four members of his group had given the same response even though this response deviated from the true state of affairs. This constituted the social pressure to conform. In Phase III, the Ss were tested in a social situation but were not subjected to such overt pressure to conform. The number of items to which S expressed agreement with the contrived group-norm was taken as a measure of his conformity. Ss were classified as independents, compliers, role-takers, or true conformers as a function of the pattern of their conforming responses in Phases II, III, and IV. Thus 80 of the original 126 Ss were classified into 47 independents, 16 compliers, 0 role-takers, and 17 true conformers.

The results when viewed as a whole may lead to the following generalizations: (1) conforming behavior is a function of (a) the situation or degree of social pressure and (b) individual differences in responding to overt and covert pressures; (2) there is a generalized conformity factor (true conformity) and the suggestion of a second or compliance factor; and (3) no relationships were discovered between conformity and the personality measures used in this study.

It was postulated that cues of seeing oneself as different from peers may arouse anxiety which leads to conformity, and, furthermore, individuals conform because of a need to be accepted by other individuals and groups. Speculations were made regarding possible differences between true conformers and compliers and it was suggested that the former might be field-independent, introverted and primarily dependent on associative processes, while the latter might be field-dependent, extroverted and primarily dependent on external stimulation. Finally, it was suggested that the lack of a demonstrated relationship between conformity and personality may have been a function of either an inadequate theory, or insensitive and inappropriate instruments for measuring the constructs, or both.

Microfilm $2.00; Xerox $6.80. 142 pages.

THE PERCEPTUAL, ABSTRACTING AND PLANNING PERFORMANCES OF SELECTED ADOLESCENT GROUPS

(L. C. Card No. Mic 58-3153)

Loren Charles Fitzhugh, Ph.D.
Purdue University, 1958

Major Professor: J. M. Hadley

The research was designed to test two hypotheses. The first was that when the performances of four groups of adolescent male subjects were compared, the performance of the Delinquent Group would more closely approximate the performances of the Brain-Damaged Group and the Psychotic Group, than it would the performance of the Normal Group. The second was that when compared with the clinical groups, the test performance of the Delinquent Group would more closely approximate the performance of the Brain-Damaged Group than it would the performance of the Psychotic Group.

The subjects in this study were four groups of white, male adolescents. The Normal Group was composed of 21 high school students, carefully screened to eliminate those who were delinquent or suffering from intra-cranial organic pathology. The Brain-Damaged Group was composed of 16 hospitalized adolescent patients, diagnosed as being brain-damaged. The Delinquent Group was composed of 21 adolescents who had been apprehended and detained for antisocial behavior. The Psychotic Group was composed of 20 adolescent hospitalized patients having been diagnosed as Psychotic. These four groups were compared as to performance on the Ellis Visual Designs Test, the Marble Board Designs, the Wisconsin Card Sorting Test, and the Trail Making Test (Part B). These tests were chosen to measure perceptual, abstracting and planning abilities of the subjects. The scores obtained were subjected to an appropriate statistical analysis.

It was found that the Marble Board Designs did not significantly differentiate among the performances of the four groups, which finding is suggestive that the test is not satisfactory for use with subjects in the age range studied.

The Trail Making Test (Part B), the Ellis Visual Designs Test, and the Wisconsin Card Sorting Test all differentiated significantly between the Normal Group and the Brain-Damaged Groups of subjects, but only the Trail Making Test (Part B) differentiated the Normal Group and the Delinquent Group at a significant level. However, a strong

trend toward a significant difference between the performances of the Normal Group and the Delinquent Group was observed on the Ellis Visual Designs Test.

The results of no single test supported both hypotheses. The first hypothesis was supported by the results obtained from the Trail Making Test (Part B), and trends in the hypothesized direction were observed through the use of the Ellis Visual Designs Test and the Wisconsin Card Sorting Test. The second hypothesis was supported by the results of the Ellis Visual Designs Test, but on no other test used.

Although the instances where the Delinquent group was not differentiated from the Brain-Damaged group should not lead us to the inference of the presence of intra-cranial organic pathology in the Delinquent group as a whole, it is apparent that the delinquent's performance tended to be different enough from that of the normal subjects to leave open to question the degree of efficiency of their perceptual, abstracting and planning behavior.

Microfilm $2.00; Xerox $6.00. 125 pages.

RESPONSE STRENGTH AS A JOINT FUNCTION OF DEPRIVATION (h) AND PREFEEDING (A)

(L. C. Card No. Mic 58-3917)

Robert Leonard Gossette, Ph.D.
The University of Connecticut, 1958

Conventionally, hunger drive is conceptualized as a theoretical construct, receiving empirical anchorage antecedently through appropriate experimental operations such as hours of deprivation, and behaviorally through changes in the strength of various classes of responses. However, hunger drive as a formal construct has remained operationally impoverished in that nearly all attempts to scale response strength as a function of drive have focused upon food deprivation as the antecendently defining condition. One promising method of controlling hunger drive is offered by immediately prefeeding the subjects prior to experimental testing. But as prefeeding must always be superimposed upon some value of deprivation, it is first necessary to determine how response strength varies as a joint function of deprivation and prefeeding, before prefeeding as a formal operation for the definition of hunger drive may be related to changes in response strength.

Two experiments were performed. The first experiment was a preliminary step to determine how four measures of response strength varied as a function of deprivation, and to facilitate assignment of absolute amounts of food to be prefed. The second experiment explored the relationship between the same four response measures and hunger drive defined conjointly by deprivation and amount prefed.

Six albino rats, the subjects for both experiments, were each repeatedly exposed to three values of deprivation: 2, 11, and 23 hours. The particular sequence for each subject was randomly assigned. At the end of each deprivation period, they were permitted to respond in a modified Skinner box, under 100% reinforcement, until satiated. Four measures of response strength were recorded: total number of responses to satiation, total time required to satiate, initial response rate, and overall rate of satiation. No other food was given. This procedure was followed for about thirty days, and constituted Experiment I. For Experiment II, three values of prefeeding were selected: .25, .50, and .75 of each subject's mean total number of responses to satiation, under each deprivation condition. These prefeed values were translated into absolute amounts of food for each subject under each deprivation-prefeed treatment combination. Prefeeding operations were timed to approximate the characteristic rate of response for each subject in Experiment I at each level of deprivation. The basic hypothesis tested by the second experiment was that comparable values of prefeeding and "self-feeding" lead to comparable changes in response strength, measured as in Experiment I, at each level of deprivation.

The results of the two experiments may be summarized as follows:

1. Response strength, when measured by total number of responses, total time to satiation, and initial response rate, is a negatively accelerated increasing function of deprivation over the range of 2, 11, 23 hours.

2. Response strength, when measured by total number of responses, and total time to satiation, is a linearly decreasing function of amount prefed, with two restrictions:

   a. Varying amounts of prefeeding have no reliable effect at 2 hours deprivation.

   b. There is a slight tendency for all subjects to "overeat" or exceed their predicted response strength values on the .75 prefeed condition, suggesting the effect of some uncontrolled variable, tentatively identified as either a work or an associative variable.

3. Two measures of response strength, rate of satiation and initial response rate, proved to be relatively insensitive to the effects of prefeeding, and thus, presumably, to changes in motivation; instead they appear to reflect associative factors related both to the preceding experimental training, and to characteristics of the eating behavior of rats.

4. Once an animal's satiation function has been established for a given value of deprivation, prefeeding promises to be an economical and reliable control of hunger drive for those investigations which require successive changes in drive strength.

Microfilm $2.00; Xerox $5.40. 110 pages.

THE EFFECTS OF SET AND REINFORCEMENT IN VERBAL CONDITIONING

(L. C. Card No. Mic 58-3918)

William Eaton Hall, Ph.D.
The University of Connecticut, 1958

The purpose of this study was to investigate the effects of instructional set, intensity of reinforcement, and sex of the Ss on verbal conditioning.

The instructional set was varied in three ways: (a) Ego-Orientation, (b) Task-Orientation, and (c) No-Orientation instructions. In the Ego-Orientation instructions the Ss were told that they were taking a test of verbal intelligence, whereas in the Task-Orientation instructions they were informed that they were merely helping E evaluate a task. Under the No-Orientation condition the Ss were told only how to do the task. The intensity of reinforcement was also varied in three ways: (a) "Good," a strong verbal

reinforcement, was offered to one group of Ss, (b) "Mm-Hmm," a weak verbal reinforcement, was offered to a second group of Ss, and (c) a third group of Ss received no reinforcement throughout the experiment. An equal number of males and females were included in the experimental population.

The task material consisted of 120 3x5 cards which were presented one at a time to each S. Each card contained six personal pronouns types in random order followed by a common verb in the past tense. The S was asked to make a simple sentence by selecting any one of the six pronouns and using it with the verb. A total of 72 Ss was employed. They were predominately college freshmen and sophomores.

The first 20 trials were administered to all Ss in the absence of any reinforcement or instructional set. The instructional sets were then introduced, and the remaining 100 trials administered. The Ss were offered "Good," "Mm-Hmm," or no reinforcement every time a "critical" pronoun was chosen. Following the completion of the trials the Ss were asked several questions concerned with: (a) the effects of the instructional sets, and (b) the degree of a awareness.

The amount of verbal conditioning obtained was a function of the instructional set and the intensity of the reinforcement, but was not related to the sex of the Ss. "Good" was instrumental in producing verbal conditioning irrespective of the instructional set under which it was employed, but the amount of verbal conditioning obtained with this reinforcement was dependent on the instructional set. The reinforcement "Mm-Hmm" produced verbal conditioning only under the Ego-Orientation instructional set. The interaction of instructional set and intensity of reinforcement was also significant.

The implications of these results for future verbal conditioning studies and for psychotherapy were discussed in terms of an hypothetical analysis of the interpersonal process. Microfilm $2.00; Xerox $4.60. 88 pages.

A FACTOR ANALYTIC STUDY OF PSYCHIATRIC TYPES

(L. C. Card No. Mic 58-3500)

Ann Shedden McColskey, Ph.D.
The University of Florida, 1958

This research represents an application of factor analytic techniques to the problem of construction of a more reliable, veridical, and efficient model for the descriptive classification or diagnosis of psychiatric patients than presently exists. A transposed factor analysis was performed on the matrix of correlations among 90 subjects, representing the Acute Intensive Treatment Service and the Continued Treatment Service of a typical, large Veterans' Administration neuro-psychiatric hospital. The correlated data consisted of 90 Q-sorts of an inventory of 89 items descriptive of the abnormal personality, as observed in the context of ward life. Each Q-sort represented the average of a pair of independent ratings by hospital aides and nurses. Ratings of the severity of disorder on a four-point scale also were obtained for each patient, to preserve intensitive differences among the 90 behavioral profiles which would have been lost in the correlational process.

Concurrently, the 89-item inventory of abnormal traits was utilized to obtain Q-sorts describing, 15 major diagnostic concepts, by four experienced psychiatrists and psychologists. The averaged Q-sort--the common diagnostic stereotype--in each case was to be correlated with the observed factor-types, in order objectively to compare the two classificatory systems.

Twelve bipolar factor-types were discovered in this sample, which bear a strong resemblance to types reported in other studies. The results suggest that moderately-to-severely disordered types exert a suppressant effect on mild types, in a representative sample of patients, and also that the factorial system could be ordered or organized in terms of a smaller number of second-order factors. From inspection of the behavior profile, or the ranked array of traits by factor-scores, for each type, provisional labels were suggested. Type A is a constrained, phobic-obsessive personality. Type B is characterized by resistiveness, with variable affect. Type C is a withdrawn, resistive, potentially labile, paranoid personality. Type D exemplifies depression, tinged with anxiety, in a well-integrated personality, while type E depicts flattened pseudonormality. Type F resembles an uncontrolled psychopath. Type G presents a picture of agitated withdrawal, and type H', of generalized deterioration of control. Type I is an example of hysteric depression in an inadequate personality, and type J represents inert-depressive withdrawal. Type K typifies catatonic constriction with asocial irritability, while type L' is a hostile, deteriorated catatonic.

The correlation between the stereotypes and the observed factor-types was consistently moderate, and was in part a function of the marked convergence of the former on five of the factor-types. There was also an impressive discrepancy between the correlations of the subjects with the stereotypes and their actual staff diagnoses, indicating a divergence between theory and practice, as well as between theory and observed fact. Further analysis provided no support for the notion of a schizophrenic domain, of a manic-depressive entity, or of mutually exclusive subdomains of psychosis, neurosis, and personality disorder. It was concluded that typological classification, amplified by gradated severity of disorder ratings, holds promise of a greater degree of economy and precision than that provided by the current system of nomenclature in this domain. Microfilm $2.75; Xerox $9.40. 210 pages.

AN INVESTIGATION OF SOME CORRELATES OF VOCATIONAL INTEREST SIMILARITY BETWEEN FATHERS AND SONS

(L. C. Card No. Mic 58-3945)

Paul Lyman Metzger, Ph.D.
University of Oregon, 1958

Adviser: Leona E. Tyler

The purpose of this investigation was to delineate some of the correlates of vocational interest similarities between fathers and their sons. Previous research has shown a wide range of scores in father-son resemblances, but no one has attempted to find out what factors are related to vocational interest similarity.

Based upon a role theory of interest development, a

general working hypothesis, a corollary to it, and nineteen specific hypotheses were drawn up. The specific hypotheses were designed to test for correlates of vocational interest similarity in the areas of personality, intelligence, personal adjustment and socio-economic factors.

A sample of forty father-son pairs was drawn from the local community. Both the fathers and the sons were given the Strong Vocational Interest Blank, a free association personality test, the Thorndike Vocabulary Test, a General Information Questionnaire, and a Role Expectancy Questionnaire.

Since the specific hypotheses were designed to test the similarity of a father and son on each of the several variables, only second order scores could be used. Thus, similarity of vocational interests was defined as the number of like primary and the number of like reject scores on the Strong Vocational Interest Blank. Other similarity scores were found by obtaining the difference between the fathers' and the sons' scores on a given test. Both primary and reject pattern scores were used as a criterion of vocational interest similarity, in recognition of the fact that interest similarity can be both positive and negative in direction.

Because of the nature of the scores that were used, parametric statistical methods were ruled out and a 2x2 Chi square test was applied. It is recognized that this statistic is not as efficient as some other procedures, but it has the advantage of easily handling data that has both skewed distributions and many tie scores.

The results of this study gave support for eight of the nineteen hypotheses at the .01 level and four at the .03 level of significance. It was found that similarities between fathers' and sons' age and intelligence, and the fathers' level of personal adjustment, were related to like reject scores on the SVIB; while father-son resemblances on the number of like words on the Free Association Test; the clinical scales of schizophrenia, manic phase, sexual interest, internal aggression, compulsion; and the ideal role agreement were related to the number of like primary scores. The son's estimate of his father's job satisfaction was the only variable related to both criteria.

The results of this study were compared with previous studies of the family's and father's influences on sons' interest development. It was found that these results generally support those of the previous investigations.

The results were then related to several different theories of vocational interest development. This comparison led to the conclusion that, while learning-genetic theories might be able to handle most of the data found in this study, they were of little help in understanding the processes involved.

The results were then discussed in relation to the theories of Carter, Bordin and Tyler. In this discussion we found that identification concepts were an integral, if not a core, concept among all three theories. It was concluded that an identification theory could handle all of the results of this study; but because of several objections to the exclusive use of this theory, it was suggested that the use of Kelly's role theory might offer a more adequate model for understanding the meaning and development of vocational interests. Microfilm $2.00; Xerox $5.20. 102 pages.

THE RELATIONSHIP BETWEEN CHILDREN'S ADJUSTMENT AND PARENTAL ACCEPTANCE

(L. C. Card No. Mic 58-5463)

John Alexander Monkman, Ph.D.
University of Illinois, 1958

The general hypothesis of this study states that there is a positive relationship between parental acceptance and children's adjustment. The connection between these variables has been deemed an important one both in clinical lore and in the findings of many research investigations. Four subsidiary hypotheses deal with two sources of measurement of acceptance, children's perceptions of their parents' attitude and direct measurement from the parents themselves. These four hypotheses also specify that the relationship holds for the measuring instruments of projective-test and self-report questionnaire. An operational definition of acceptance-rejection is derived from clinical lore and several research studies, and is used in developing the measuring instruments of the study.

Subjects are drawn from families in the research program at the Psychological Clinic, University of Illinois, during 1956-57. For the data from the projective-test the number of families represented is 36. Half of these are families in which the child has been referred for emotional problems, and half families in which no such referral had been made. Male and female children are equally represented in each group. The subjects for the questionnaire data are larger in number, but the large overlap with the projective-test sample and separate data analyses for subjects common to both groups show that the results to follow are not a function of the differences in samples for the two instruments.

Children's adjustment is measured in two ways: the clinic-referred children described above are defined as maladjusted, the other group as well-adjusted; and the severity of each child's adjustment problems is rated on the basis of separate clinical interviews with each parent. The projective-test measures of acceptance are obtained from a new projective instrument depicting parents and children in interaction. The stories of each subject are rated separately on four Fels Parent Rating Scales related to the construct defined above, and on an overall scale of acceptance whose seven points parallel those of the defined scale. The answers to questions asked after each subject's stories yield another measure of acceptance (or, for children, perceived acceptance). The self-report questionnaire consists of 50 items answered by each subject on a seven-point scale. These items ask for report of the parent's accepting-rejecting behavior toward the child in the the family. Data are collected and analyzed separately for mothers, fathers, and children. Parametric statistical methods are used for data from the projective-test, and non-parametric methods for the questionnaire data. Reliability investigations of the separate measures yield interrelationships among measures of the same construct, comparisons between judges in making ratings on projective-test stories, and internal consistency coefficients which are adequately high.

The questionnaire data yield highly significant results in support of the hypothesis, i.e. mothers and fathers of well-adjusted children are more accepting than are parents of maladjusted children. Furthermore, maladjusted children perceive their parents as being less accepting than

do well-adjusted children. The projective-test data yield no results in support of the hypothesis. Although it is possible that these results indicate that the projective test is invalid for these purposes, for a number of reasons it is considered more plausible to interpret them as meaning that parents of well-adjusted children are more accepting on an overt behavioral level than are parents of maladjusted children, but that the two groups do not differ in their unconscious, underlying acceptance attitudes toward their children. Important findings for further research are: 1) fathers' attitudes are as strongly related to children's adjustment as are mothers' attitudes; 2) maladjusted children's mothers and fathers are more different from each other in acceptance attitudes than are mothers and fathers of well-adjusted children (on the questionnaire data). Several extensions of the study's findings and revisions of the instruments are discussed.

Microfilm $2.00; Xerox $7.00. 149 pages.

INKBLOT PERCEPTION AND PERSONALITY: AN EXPERIMENTAL DEPARTURE FROM THE RORSCHACH TEST

(L. C. Card No. Mic 58-3996)

Egbert Nelson Pareis, Ph.D.
The University of Texas, 1958

Supervisor: Professor Wayne H. Holtzman, Ph.D.

This investigation represents an exploratory study of a group form of a new inkblot test developed by Wayne H. Holtzman. For the most part the stimuli used were similar to those of the Rorschach Test. Slides were prepared of 40 blots which formed an early experimental series in the development of the individual form of the test. Booklets with reproductions of the blots were also devised to allow for group administration. By employing a much larger number of blots than is used in the Rorschach Test and restricting subjects to one response per plate it is possible to achieve adequate estimates of internal consistency reliability. It was thought that many of the negative or equivocal results which had been obtained in validity investigations employing the Rorschach Test might have been due to the unknown degree of reliability of that instrument. A series of hypotheses derived from Rorschach literature was set up to be tested. It was predicted that individuals whose records included many responses determined by white space in the blots would be ranked high on the trait "Contrariness" by members of their living group who knew them well. Similarily, it was hypothesized that positive correlations would exist between the perception of movement in the blots and sociometric rankings of "Imaginativeness"; between responses determined primarily by color and the trait "Impulsiveness" and between responses determined primarily by form and secondarily by color and the trait "Sociability."

180 subjects in 15 groups took part in the study. Of the above hypotheses only the relationship between the perception of movement and the trait "Imaginativeness" proved statistically significant ($r = .16$, $p = .05$) and then only when movement was scored by means of a refined scale.

In a second part of the study various groups, who might be expected to differ in personality characteristics, were compared. Some differences were found between the responses of men and women, but major differences were noted between a group of divinity students and the remaining men in the sample.

It was concluded that the major contribution of the investigation was to indicate the feasibility of a refined group form of the Holtzman Inkblot Test, and suggestions were offered as to promising areas for future development.

Microfilm $2.00; Xerox $4.60. 86 pages.

THE EFFECT OF VERBAL REINFORCEMENT ON THE RECALL OF EARLY MEMORIES

(L. C. Card No. Mic 58-5478)

Herbert Callister Quay, Ph.D.
University of Illinois, 1958

The verbal productions of patients undergoing psychotherapy have served a dual function for most modern personality theorists. These verbalizations have been used both to suggest hypotheses about the dynamic and historical causes of behavior and to test the validity of these same hypotheses. If the verbal productions of patients are to be used in hypothesis testing, it must be assumed that the psychotherapist, however minimal his participation might appear, does not influence his patient's utterances.

The purpose of this study was to test the hypothesis that clinically meaningful, personally relevant verbalizations could be manipulated in an interview type situation within the paradigm of operant verbal conditioning.

The method of the study was to have college students report memories of their early childhood in an interview situation. Two categories of memory topics were chosen for selective verbal reinforcement. These categories, mutually exclusive and all-inclusive, were "family" memories and "non-family" memories. Essentially, a memory was classified as "family" when some member of the family took a major role in the rememberance, while a memory was classified as "non-family" when a family member did not appear or took only a very minor role. The reliability of this classification was tested by the use of an independent judge who classified 20 memories from each of 11 Ss. Percentage of agreement between this judge and E ranged from 100% to 90% with a mean of 96%.

After a baseline was established in a "free operant" period of 10 minutes duration, Ss, who had been alternately assigned to the "family" or "non-family" group, were reinforced by E saying "uh-huh" after each occurrence of the critical category. The experimental period consisted of two half-hour sessions, approximately one week apart.

Data were analyzed by a comparison of the relative frequency of reinforced responses in the operant period to the relative frequency in the following reinforcement period.

Results indicated that 13 of the 16 Ss in the "family" group increased in their relative frequency in the reinforcement period. Under the hypothesis that increases and decreases were equally likely, this result had a one-tailed binomial probability of .01064. In the group in which "non-family" memories were reinforced, 16 of 18 Ss increased in their relative frequency of "non-family" memories in the

reinforcement period. This result had a probability of .00377.

Ss exhibited differences in their increases with reinforcement. These combined increases were not found to be related to sex, "family" or "non-family" group, or initial operant level.

The degree of awareness for the experimental variables was assessed for each S by means of a questionnaire mailed at the close of the study. Of the 30 Ss who returned the questionnaire, only one S was aware of the response-reinforcement contingency. Fifteen Ss were aware of E saying "uh-huh," but all denied having been influenced in any way. Three Ss reported that E seemed more interested in certain topics than others, but none named the topic and all denied having been influenced. Eleven of the Ss reported no awareness whatsoever. Awareness, as crudely placed on a continuum in this study, was found unrelated to the presence or absence of conditioning or the magnitude of the effect.

Results were interpreted to indicate that minimal verbal responses of one person may affect another individual's verbal recall of personally relevant early memories. Under such conditions the use of the psychotherapeutic interview as a testing ground for hypotheses about the causes of behavior is highly questionable. The use of changes in verbal behavior to index psychotherapeutic success or failure are also open to question.

Microfilm $2.00; Xerox $3.00. 55 pages.

CAPACITY FOR MUTUAL DEPENDENCE AND INVOLVEMENT IN GROUP PSYCHOTHERAPY

(L. C. Card No. Mic 58-3119)

William Ryan, Ph.D.
Boston University Graduate School, 1958

Major Professor: Austin W. Berkeley

Introduction

This research was designed to demonstrate a relationship between specific personality characteristics and involvement in group therapy. Based upon the work of many writers in the field of group dynamics and group psychotherapy, such as Lewin, Alexander, Bach, Slavson, Mann and others, as well as clinical observations, an assumption was made that a psychotherapy group is a situation of mutual dependence. The members of a therapy group, to exist and function as a group, are required to help one another, to give to one another and to take from one another.

On this assumption, the hypotheses was formulated that an individual's involvement in such a group would be significantly related to a complex of personality factors which was termed capacity for mutual dependence.

Capacity for mutual dependence was analyzed into two factors, potential for giving and management of dependency wishes. Potential for giving was defined as ability to empathize with others, capacity for forming relationships with others, capacity to delay gratification of needs and capacity to derive satisfaction from gratifying the needs of others. Persons high in this potential were termed "giving," those low in this potential were termed "nongiving."

Management of dependency wishes was conceptualized in terms of the extent to which an individual accepted or denied his wishes to have other persons gratify his needs for him. The dependency management continuum ranged from extreme dependence-acceptance at one end to extreme dependence-denial at the other end, with the middle, dependence-flexible, range exemplified by those individuals who manage their dependency wishes in a more flexible manner.

Individuals who were both giving and dependence-flexible were categorized as having a high capacity for mutual dependence, all others as having a low capacity for mutual dependence.

Hypotheses

Three interrelated predictions were made in the form of a major hypothesis and two minor hypotheses:

1. Major hypothesis.

Persons with a high capacity for mutual dependence would become more involved in a psychotherapy group than persons with a low capacity for mutual dependence.

2. First Minor Hypothesis

Giving individuals would become more involved in a psychotherapy group than nongiving individuals.

3. Second Minor Hypothesis

Dependence-flexible individuals would become more involved in a psychotherapy group than individuals tending toward either dependence-denial or dependence-acceptance.

Procedure

Two psychotherapy groups, with a total of 25 members, served as subjects for this research. Personality factors were assessed through the use of specially constructed Rorschach scales, using a standard score format. Rorschach indices related to potential for giving were $\underline{M}$, $\underline{H}$, $\underline{FC}$ and $\underline{FC} - (\underline{CF} + \underline{C})$; those related to dependency management were $\underline{R}$, $\underline{F}\%$ $\underline{Ad + Hd}\%$, $\underline{Dd + S}\%$, $\underline{A}\%$, $\frac{\underline{Y + V}}{\underline{T}}$, and number of content categories. Involvement in the group was measured primarily by the number of weeks the individual retained membership in the group and secondarily by therapists' ratings of activity and involvement. The period of study was sixteen weeks.

Results

1. Major Hypothesis.

Patients with a high capacity for mutual dependence continued membership longer than patients with a low capacity for mutual dependence ($\underline{P}$: less than .01) and were also rated by therapists as being more active and involved ($\underline{P}$: less than .01).

2. First Minor Hypothesis.

Giving patients continued membership longer than nongiving patients ($\underline{P}$: less than .01) and were rated by therapists as being more active and involved ($\underline{P}$: less than .05).

3. Second Minor Hypothesis.

Dependence-flexible patients continued membership longer than dependence-denial or dependence-acceptance patients ($\underline{P}$: less than .05) and were rated by therapists as being more active and involved ($\underline{P}$: between .03 and .07).

Microfilm $2.00; Xerox $6.60. 136 pages.

A STUDY OF SOME FACTORS IN THE BENDER GESTALT REPRODUCTIONS OF NORMAL AND DISTURBED CHILDREN

(L. C. Card No. Mic 58-3879)

William Harold Simpson, Ph.D.
The University of Oklahoma, 1958

Major Professor: Dr. Milbourne O. Wilson

Three factors are assumed to be embodied in the total act of reproducing the Bender Gestalt designs, namely, perception, interpretation, and execution. It was the purpose of this study to examine the validity of assigning deviant performance exhibited in Bender Gestalt reproductions to "interpretative factors" which obtrude between perception and execution. Accordingly, the following hypotheses were tested: (1) normal and disturbed first grade boys of average intelligence differ significantly in copying ability; (2) they differ significantly in discrimination in the perceptual phase of the Bender Gestalt; and (3) they differ significantly in their reproductions of the Bender Gestalt.

The subjects used in this study consisted of twenty-five emotionally disturbed first grade boys and twenty-five normal first grade boys, all of average intelligence and matched for age and I.Q.

Each of the subjects in both groups was given the Bender Gestalt. Prior to the administration of the Bender Gestalt all subjects were required to copy four simple geometric figures, namely, a cross, a square, a vertical diamond, and a horizontal diamond. This procedure was used to evaluate the assumption about copying ability.

The test of the assumption about the perceptual phase required that the subjects choose a drawing like the one shown them to copy during the regular administration of the Bender Gestalt. Choices were made from a series of drawings consisting of a replica of the original Bender design and three replicas of Bender drawings. The three replicas of Bender drawings differed in distortion from the original Bender stimuli and from each other as well.

Analysis of the data revealed that no differences existed between the normal and disturbed subjects in either copying ability or discriminative ability. Thus, the first and second hypotheses were rejected. However, a significant difference was found to exist between their reproductions on the Bender Gestalt. Since the differences in reproductions could not be assigned to differences in copying ability and discriminative ability, the differences obtained must have been due to differences in interpretation. Therefore, the third or major hypothesis of this study was confirmed.

Microfilm $2.00; Xerox $4.80. 92 pages.

DISCREPANCY IN THE MEANING OF SELF IN A MULTILEVEL PERSONALITY SYSTEM AND EMOTIONAL DISTURBANCE

(L. C. Card No. Mic 58-5498)

Aaron Smith, Ph.D.
University of Illinois, 1958

Theoretical formulations deriving from clinical observations have given an important place to the multi-level conception of personality. Emotional disturbance has frequently been viewed as arising from conflict among various levels of personality. Often it has been assumed that the greater the inter-level conflict, the more emotionally disturbed is the individual. However, there have been a number of methodological barriers to multi-level research. Especially difficult has been the problem of securing an adequate system of dimensions for inter-level comparisons.

Of major interest in any multi-level comparisons are the congruities and discrepancies among the meanings of self. In those single level studies comparing self-concepts, usually by means of self-ideal-self discrepancies, the results have been contradictory. One possible explanation for their contradictory results lies in the use of global measures of profile discrepancy such as D-scores. Those measures may very well complicate or obscure more basic relationships.

In the present study, a group of 49 neurotic clients were given a large battery of objective and projective tests before their first psychotherapy session. Four of these tests were ordered in terms of the relative importance of conscious vs. unconscious determinants of their content.

The client's perception of himself was independently estimated from each of the four tests and comparisons were made among them. The assessments of self-concept were made in terms of Osgood's dimensions of meaning, i.e., Evaluation, Potency, and Activity. Scores on these dimensions were directly computed in two of the tests, the Semantic Differential and the Ewing Personal-Rating Form. In the other two tests (the Gilbert Self-Interview and the TAT) self-concepts were inferred through a newly developed method of content analysis. This latter method involved ratings on Osgood's dimensions, the behaviors, feelings, and thoughts attributed to the self in the Gilbert test and to the hero in the TAT. Scores on each of the three meaning dimensions for each of the four tests, and also profile discrepancies among the scores on various tests, were related to the degree of the patient's emotional disturbance. Using a combination of ranking and rating procedures, the degree of emotional disturbance of the patient had been independently judged by the therapeutic counselor.

The empirical relationships demonstrated in this study led to the following conclusions.

1. In a population of slightly to severely neurotic patients, one general self-evaluative factor accounted for 85 percent of the variance in the equally weighted composite of six of the seven reliable variables. The assumption that various levels of personality were represented in the tests was consequently rejected.
2. The D-measures of profile discrepancy between tests were not related to the criterion of emotional disturbance.
3. The degree of emotional disturbance was not predicted from any of the measures of self-concept.
4. Several reliable measures of self-concept had a significant, non-monotonic, curvilinear relationship to the degree of emotional disturbance. Severely disturbed clients saw themselves as more worthless, weaker, and more passive than slightly disturbed clients; however, they also saw themselves as more valuable, stronger, and more active than moderately disturbed patients.

Microfilm $2.00; Xerox $4.40. 83 pages.

AN INVESTIGATION OF THE CONSTRUCTS "EFFECTIVE INTELLIGENCE" AND "SOCIAL COMPETENCE" WITH THE COPPLE SENTENCE COMPLETION TEST UTILIZING A SCHOOL OF SOCIAL WORK POPULATION

(L. C. Card No. Mic 58-5282)

James Thomas West, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor George Copple

The present study has investigated by means of construct validation the Copple Sentence Completion Test (CSCT), a relatively new, neutral, and highly unstructured instrument. The study has attempted to confirm previous indications that this test measures a new concept, "effective intelligence," and to investigate initially another hypothesized concept, "social competence," utilizing a different scoring procedure.

Fifty-five students of a school of social work, consisting of twenty-eight first year and twenty-seven second year students, were administered the CSCT and the Otis S-A Test of Mental Ability. They were ranked by their peers and by the faculty on the qualities of effective intelligence and social competence. Other criteria utilized were course grades and field work grades.

The CSCT, scored by Copple for effective intelligence, had an odd-even reliability of .84 (.91 corrected by Spearman-Brown). Two other scorers, using standardized scoring directions, had odd-even reliabilities of .90 and .91 (.95 when corrected) and correlated with each other and with Copple from .90 to .94. Thus, high internal consistency seems to exist and scoring can be performed successfully by others than the test author.

The CSCT, scored for effective intelligence, correlated as predicted with the various criteria, namely, .57 and .55 with course grades for the first and second year classes respectively, .43 and .13 (ns) with Otis scores, .59 and .43 with faculty rankings, and .52 and .34 (ns) with peer rankings. The Otis scores did not predict criteria as well as the CSCT nor did they significantly improve the predictive value of criteria when used in multiple correlations with CSCT scores. The second year class rankings by both peers and faculty were of doubtful validity as judged by internal consistency. This is understandable in view of the fact that the class dispersed for six months during the school year. In general, almost all the relationships between CSCT scores and criteria were positive and significant.

The CSCT, scored by the three scorers for social competence, had odd-even reliabilities ranging from .61 to .79 (.76 to .88 when corrected). The three scorers, using individual scoring standards, correlated with each other from .56 to .71, indicating fairly adequate agreement though not reaching the level found in the CSCT scoring for effective intelligence.

The CSCT, scored for social competence, correlated with the following criteria: .48 and .66 with field work grades for the first and second year classes respectively, .39 and .33 (ns) with faculty rankings of social competence, and .41 and .02 (ns) with peer rankings. The Otis scores did not correlate significantly with the various criteria of social competence nor did they, when used in multiple correlations with CSCT scores, significantly improve the predictive value of the criteria over CSCT scores alone. More evidence appeared for the inadequacy of the second year rankings when coefficients of concordance indicated a low degree of agreement among rankers - especially peer rankers. In general, the relationship between CSCT scores and the criteria of social competence were positive and significant.

Copple's scoring of the CSCT for social competence correlated quite highly with his scoring for effective intelligence, raising doubt over the independence of the two factors. When the effects of his scoring for effective intelligence were partialed out, no relationship between social competence scoring and the criteria of this factor remained. The evidence suggested that the criteria of social competence were heavily weighted with effective intelligence and that the two constructs were not distinct in the minds of the rankers.

The study tends to confirm the existence of the construct of effective intelligence and to support the value of the CSCT in scoring this attribute. The existence of a separate construct of social competence was not confirmed in the present study.

Microfilm $2.00; Xerox $5.00. 99 pages.

TIME ESTIMATION MEASUREMENTS AND SCHIZOPHRENIA

(L. C. Card No. Mic 58-5580)

David Jay Wright, Jr., Ph.D.
University of Houston, 1958

Previous investigators have verified anecdotal reports of alterations in the time sense of schizophrenics by demonstrating differences between healthy subjects and patients in their judgments of one second's duration. The schizophrenic reported less clock time as equivalent to his concept of a second than did the normal subject. It was suggested that this difference may be the result of the schizophrenic being more vulnerable to the anchors in the traditional arithmetic stimulus series, a psychophysically asymmetrical series which contains more j.n.d. units between stimuli at the lower end than at the upper end of the scale. This series asymmetry was thought to have a downward-pulling or anchor effect upon the judgment of duration. This possibility was explored by comparing the temporal judgments of schizophrenics and healthy subjects obtained with the use of an arithmetic stimulus series with those obtained with the use of a logarithmic stimulus series, a more symmetrical stimulus series in that the j.n.d. units between stimuli are more equally spread throughout the stimulus series range. It was hypothesized that the temporal judgments of the schizophrenics would not differ from those of the healthy subjects when the logarithmic increment series was used, and that the arithmetic increment series would differentiate among three schizophrenic groups (i.e., chronic schizophrenics, acute schizophrenics, and schizophrenics in remission) and between the schizophrenic groups and the healthy subjects. It was also hypothesized that the judgments of healthy subjects would be vulnerable to the anchors in the arithmetic series, but not as much as those of the schizophrenics.

Forty healthy subjects, 36 acute schizophrenics, 18

schizophrenics in remission, and 37 chronic schizophrenics, were required to judge auditory stimuli, which were presented in both an arithmetic increment and a logarithmic increment series of ascending and descending runs using a modified method of limits, as to whether each stimulus was more or less than their concept of one second. Each subject received both stimulus series and the presentation order was counterbalanced for each group.

An analysis of the data produced the following information:

1. Healthy subjects used less clock time in their estimation of one second with an arithmetic series than with a logarithmic series.
2. Acute schizophrenics used less clock time in their estimation of one second with an arithmetic series than with a logarithmic series.
3. Healthy subjects used more clock time in their estimation of one second than acute schizophrenics with an arithmetic series.
4. Healthy subjects and acute schizophrenics did not differ in the amount of clock time estimated to be one second with the logarithmic series.
5. Acute schizophrenics used more clock time in their estimation of one second than did chronic schizophrenics with an arithmetic series.
6. Schizophrenics in remission did not differ in the amount of clock time estimated to be one second between the arithmetic and the logarithmic series.
7. Schizophrenics in remission used more clock time in their estimation of one second than any other group with both stimulus series.

These findings were discussed in terms of their psychophysical and psychopathological implications. It was suggested that future investigators should consider the kind of stimulus series in accounting for patient-normal differences, and that the logarithmic increment represents a more natural psychophysical step interval than the arithmetic increment. It was also suggested that the schizophrenic's vulnerability to anchors reflects an ahistoric frame of reference which may be considered a basic aspect of the schizophrenic illness, and that vulnerability or reaction to anchors reflect various stages of the advancement or diminution of the schizophrenic process.

Microfilm $2.00; Xerox $4.60. 90 pages.

PSYCHOLOGY, EXPERIMENTAL

THE EFFECT OF STIMULATION OF THE FORNIX AND CAUDATE ON THE BEHAVIOR OF THE CAT

(L. C. Card No. Mic 58-3086)

John Joseph Barry, Jr., Ph.D.
Boston University Graduate School, 1958

Major Professor: J. M. Harrison

This experiment stemmed from the contradiction existing between the recent findings of Olds and Delgado et. al. concerning the effect of stimulating the fornix. The original design was later broadened to include the caudate when additional data was published by Heath e. al. This evidence also conflicted with some earlier findings by Olds regarding this structure.

The main problem was to determine whether stimulation of the caudate and fornix was noxious to the animal. In order to objectively appraise the effects of stimulation, it was necessary to provide some criterion of behavior as a base.

For this reason the operant conditioning technique of Skinner was chosen, and grey noise was the noxious stimulus. The animals were conditioned to terminate the noise by pressing a lever. The intensity of the noise was plotted against the rate of responding of the animal (the excape function).

Each animal then had 4 electrodes implanted, two in each hemisphere. The targets for the electrodes were the fornix and the caudate.

After a short recovery period, the animals were again tested on the noxious stimulus. The results of this test period were used as the base to appraise the effects of stimulation.

The stimulation sessions were conducted in the following manner:

a) With the noise stimulus constant at 15v. the stimulation was gradually increased in intensity. Each time the animal pressed the lever, both noise and stimulation were terminated.

b) With the noise gradually reduced to zero, the stimulation was gradually increased in intensity, as in the previous contingency. Depression of the lever terminated both stimulation and noise, as before.

c) With the noise at 0, stimulation was given for each bar press (Olds effect).

d) Finally, with the noise at 0, stimulation was administered at specified intervals over a wider range of intensities. During this test, the motor effects of the stimulation were noted.

In the first two contingencies rate-intensity functions were plotted for each electrode in each animal. In the third contingency the number of responses were recorded against intensity. In the last behavior, stimulation effects were observed and noted in protocol form.

After securing data in this manner, each animal was sacrificed, and the brains sectioned and mounted. The position of each electrode in each animal was then determined.

It was found that stimulation of the fornix and caudate was not any more noxious to the animal than the original imput stimulus. The motor effect of fornix stimulation could not be clearly determined since it was impossible to control for current spread at high intensities.

Microfilm $2.00; Xerox $7.20. 152 pages.

THE EFFECTS OF VARYING INTENSITY ON THE AUDITORY TIME-ERROR

(L. C. Card No. Mic 58-3481)

John Anthony Bowland, Ph.D.
The University of Florida, 1958

The study was designed to evaluate auditory time-errors resulting from the systematic variations of the intensity of series of tones. The tones were presented in combinations of three--standard, interpolated, and comparison stimuli--under the Method of Constant Stimuli. Sixty combinations of tones differing in intensity values were presented to 26 subjects who judged the comparison stimulus either "louder" or "softer" than the standard stimulus in each case. The tone combinations were replicated in three successive trials, yielding 180 judgments per subject.

Time-errors were evaluated in three general areas: Inter-trial differences; the effects of varying standard stimuli, interpolated stimuli controlled; and the effects of varying interpolated stimuli, standard stimuli controlled. Within these general areas six hypotheses, each involving several time-error variations, were tested. These predictions were derived from Lauenstein's assimilation concept, Pratt's sinking-trace effect, and a revised Gestalt assimilation view.

The revised assimilation conception holds that the phenomenal experience of comparison is the psychological parallel of an excitation being assimilated to the traces of past excitations of a similar character. These traces are assumed to be organized in subsystems of varying stability which interact with one another and the whole gradient system.

The results lend considerable support to the revised assimilation view, while the alternative hypotheses are completely unsupported. It is tentatively concluded that the sinking-trace effect is not a universal phenomenon, but that it may be understood in terms of the revised assimilation view--namely, by interaction of a poorly organized subsystem with a system or subsystem of lesser value.

Individual differences are evaluated. Some asymmetries in the data, or unexpected results, are discussed. Suggestions are made regarding further research.

Microfilm $2.00; Xerox $3.00. 55 pages.

AN EVALUATION OF THREE ASSOCIATIONAL RATIONALES OF VERBAL GENERALIZATION

(L. C. Card No. Mic 58-3908)

Burton Herbert Cohen, Ph.D.
The University of Connecticut, 1958

The classical generalization paradigm was utilized to evaluate three theoretical rationales concerning verbal generalization. The classical generalization paradigm as it relates to verbal generalization may be stated as follows:

$X \rightarrow Y$ a pre-existing verbal habit

$X \rightarrow R$ the learning or training of a response, R, to the verbal stimulus X.

$Y \rightarrow R$ the presentation of the verbal stimulus Y in a test for generalization.

A rationale of verbal generalization proposed by Razran indicates that generalization effects are determined by the testing situation. A rationale developed by Mink specifies that generalization effects are determined by the training situation and that the strength with which Y is elicited as a free associate of X may be used as an index of generalization. The third rationale, that of Bousfield, Cohen, and Whitmarsh, specifies that the testing situation is the locus of the generalization effects and proposes a multiple associative index of generalization based upon the frequencies of occurrence of the free associates of Y which are in common with both X and the free associates of X.

Each of these rationales was evaluated by means of the modified classical generalization paradigm presented above with respect to the following three problems:

1. The influence of the type of word relationship on generalization.
2. The locus of the generalization effect.
3. The use of an index of generalization derived from free association norms as a predictor of generalization effects.

A purely verbal technique of obtaining generalization in a group situation was developed. The subjects learned a paired associates list where the pairs comprised verbal stimuli and number responses. After completion of the learning task, a test list consisting of the original stimulus members of the paired associates task, a group of related words, and a group of filler words was presented. The subjects were instructed to respond to each test word with one of the numbers used as a response item in the paired associates learning situation. The frequency with which a number response learned to a given stimulus word was given as a response to the test word with which it was related was used as a measure of the magnitude of the generalization effect.

Ten groups of subjects (N = 10 to N = 19) were randomly assigned to two experimental lists of the verbal material.

The results of the investigation may be summarized as follows:

1. The use of the purely verbal technique developed here provides a sensitive and stable method of assessing verbal generalization effects.
2. The generalization effect appears to be determined by the testing situation rather than the training situation.
3. A sensitive index of generalization may be derived from free association norms.
4. The influence of the type of word relationship upon generalization is dependent upon the magnitude of the index of generalization.
5. The theory of verbal generalization proposed by Bousfield, Cohen, and Whitmarsh, which incorporates the Razran rationale, is supported by the experimental results.

Microfilm $2.00; Xerox $5.20. 104 pages.

PROBLEM-SOLVING FLEXIBILITY AS A FUNCTION OF SYSTEMATICALLY CONTROLLED EXPERIENCE

(L. C. Card No. Mic 58-3144)

Harold James Coleman, Ph.D.
Purdue University, 1958

Major Professors: Kenneth M. Michels and
Lawrence M. Baker

This research is an investigation of the effects of single and multiple learning experience as it relates to flexibility of rats in the formation of new modes of behavior. An attempt was made to determine if differential learning experience on the part of the rat would lead to a difference in facility in new problem solutions.

A total of 75 hooded rats were used as subjects. Forty of the animals were 90 days old, and 35 of the animals were 20 days old at the start of the experiment. These animals were randomly assigned to eight different training groups. The groups were exposed to different learning experiences during the training phase. Three simple problems, T-Maze, Visual Discrimination, and Avoidance Conditioning comprised the training phase. The animals were exposed to none, one, two, or three of these learning experiences while undergoing training.

At the end of the training phase all animals were exposed to a complex sensorimotor discrimination problem, an insoluble problem, and audio-stimulation. The behavior of the animals was recorded and analyzed.

It was found that there were no differences in the performance of the animals which could be attributed to the age of the animal at the onset of the training trials.

Avoidance experience without any other training experience leads to a decrease in the performance of the animals in the complex sensorimotor discrimination problem. Animals of the control group, without any training experience, performed better than the single avoidance experience rats and as well as any of the other groups on this problem.

Single avoidance experience reduces the variability and degree of persistance of the rat when confronted with an insoluble problem. No single learning experience or combination of learning experiences can be said to lead to greater flexibility in behavior in the insoluble problem situation.

The production of audiogenic seizures by audio-stimulation is not related to the type or variety of training to which the animal was exposed. A relationship does exist between non-adaptive behavior in the insoluble problem situation and the occurrence of audiogenic seizures.

Microfilm $2.00; Xerox $3.60. 64 pages.

A STUDY OF PLACE VS. RESPONSE BEHAVIOR, LEARNING AND REASONING IN THE WHITE RAT

(L. C. Card No. Mic 58-3486)

Leming Bassett Corlis, Ph.D.
The University of Florida, 1958

The purpose of this study was to determine:

1. Is the "place" or "response" behavior of a white rat consistent?
2. What relationships exist between reasoning and "place or "response" behavior?
3. What relationships exist between speed of learning a maze habit and "place" or "response" behavior?

This experiment consisted of each of the 43 animals being run on six tasks. Four of these tasks consisted of the rat learning a one-choice-point maze and then being tested for "place" or "response" behavior. Of the two remaining tasks, used to measure reasoning, one was a modification of Maier's technique and the other was adapted from Shepard.

The findings:

1. indicate that the animals are inconsistent in their "place" or "response" behavior and do not fall into a "place" vs. "response" dichotomy. It is still conceivable that the animals fall on a continuum as to the cues that are predominant in learning a maze habit.
2. fail to find any relationship between "place" or "response" behavior and reasoning in the white rat, and
3. fail to indicate any relationship between "place" or "response" behavior and speed of learning a maze habit as measured by number of trials to criterion.

It appears that the place vs. response controversy is incorrectly formulated. The results indicate, as Restle suggests, that the animals use all of the available cues in a learning situation. Further study should attempt to identify these cues and determine their relative importance rather than follow the "place-response" experimentation classically carried on in this area.

Doubt is cast upon the assertion that the apparatus modified from Maier measures reasoning. Further research in this area should attempt to ascertain whether reasoning can occur in the white rat.

Microfilm $2.00; Xerox $3.00. 54 pages.

TRANSFER BY NORMAL AND CHRONIC WHOLE-BODY IRRADIATED MONKEYS OF A SINGLE LEARNED DISCRIMINATION ALONG A PERIPHERAL CUE GRADIENT

(L. C. Card No. Mic 58-3984)

Arnold Albert McDowell, Ph.D.
The University of Texas, 1958

Supervisor: Professor Dr. W. Lynn Brown

Introduction

Previous research studies have found that the irradiated monkey is superior to the normal monkey with respect to

performance on learning tasks such as spatial-delayed response problems, discrimination problems with reduced stimulus cues, oddity-reversal problems, and, in one study, difficult discrimination problems. These results suggest that the irradiated monkey learns more in the same number of reinforced trials than does the normal monkey. The present study was conducted to test this hypothesis.

Procedure and Apparatus

Seventeen normal, 13 low-dose irradiated, 4 intermediate-dose irradiated, and 4 high-dose irradiated monkeys were subjects. Each subject was tested 24 trials per day for 5 days on a single object-quality discrimination problem. Then, each subject was tested 24 trials per day for 5 days on each of the 4 peripheral cue conditions, the order of testing being from the least peripheral to most peripheral condition. A 2-string patterned string board was used for the peripheral cue testing. The strings were attached to the extreme eyebolt positions and ran to behind a 3-sided chimmey in the rear center of the board. The peripheral cue positions were measured along the back of the board from the chimmey to the edge of the board. Response to the string on the side carrying the positive object of the discrimination training was rewarded. A mixed type analysis of variance design was used for statistical analysis of data.

Results

Statistical analysis yielded significant F-values for groups and for conditions. All groups showed an increase in errors as the distance between the peripheral cue and the site of food reward increased. With respect to the transfer efficiency, the group were, from most to least efficient: intermediate-dose irradiates, low-dose irradiates, controls, and high-dose irradiates.

Conclusions

It was concluded that (1) efficiency of transfer of a learned discrimination along a peripheral cue gradient decreases as the distance between the site of the reward and the peripheral cue increases, (2) low and intermediate-doses of whole-body irradiation increase the efficiency of such transfer, and (3) the hypothesis that the irradiated monkey learns more in the same number of reinforced trials than the normal monkey is tenable within the low- and intermediate-dosage range.

Microfilm $2.00; Xerox $3.80. 70 pages.

VARIABILITY OF BEHAVIOR IN PROBLEMS OF DIFFERENT TYPES AND DIFFERENT LEVELS OF DIFFICULTY

(L. C. Card No. Mic 58-5277)

Emil Wolfgang Menzel, Jr., Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Gilbert W. Meier

Variability poses three basic problems: first, is it an experimentally lawful function of other variables? Second, is it systematic and predictable in the light of past behavior? And, lastly, how is it related to the efficiency of behavior? This experiment considered all of these questions; and it attempted to relate the variability which is often termed "spontaneous" (in that it appears even when not "required" by the stimulus situation) to the variability which is found when an individual faces a "real learning" problem. Toward these purposes, thirty Syrian golden hamsters were tested in problems of different types and different levels of difficulty.

Variability was found to be a lawful function of the nature of the problem situation. Three types of problems, presented on a five-unit linear T maze, elicited different levels and sorts of variability. Not only were the animals which confronted the "real learning" situation (Maze-run) distinct from those which were not differentially rewarded (Free- and Random-run), but also these latter groups were different from each other. This was true in original learning (25 trials) and in transfer, within the same situation, to a new task (12 trials); it was not true, however, when an entirely new situation was encountered later. These were differences in level of variability. Similarities were noted in the nature of the variable behavior in different problem types. Most notably, Maze-runners acted more like animals for which "anything goes" (Free-runners) than like those which cannot know "what will follow what" (Random-runners). With problems of different levels of difficulty (two-, four-, and six-choices in a single-unit maze), no changes in relative variability were noted. Further analysis indicated that total levels of change per se might have been closely specified by taking into account only the comparative complexity of the stimulus situations, and completely ignoring subjective aspects of "difficulty."

Variability was seen, secondly, to be systematic regardless of the specific difficulty of the problem. All animals (individually considered) acted in a highly predictable fashion over the course of their learning. It was suggested that failure to find systematicness in learning is often the result of inadequate criteria on the part of the experimenter, and does not stem from the erraticness of the behavior of the learner.

Finally, variability was found to be empirically distinguishable from efficiency. The differences in variability occasioned by different problem types were not related to the efficiency of original learning, of transfer to a new short-cut introduced into the same situation, or of transfer to a totally new situation.

Briefly, (a) levels of variability differed lawfully as a function of experimental conditions; (b) individuals, regardless of special conditions, were individually predictable; and (c) differences in efficiency did not relate to levels of experimentally controlled variability. It is concluded that the three basic problems of variability may be empirically as well as logically independent. There are no grounds for expecting that variability as such is always adaptive, for insofar as it is under control of the environment, high or low variability may be equally stimulus-bound and ill-conducive to the acquisition of efficient behavior. Qualitative distinctions between "spontaneous," apparently unpredictable, behavior changes and the variability that characterizes selective learning are not meaningful. Microfilm $2.00; Xerox $4.20. 79 pages.

A STUDY OF THE ADAPTIVE FUNCTIONS OF WIT AND HUMOR

(L. C. Card No. Mic 58-3993)

Walter Edward O'Connell, Ph.D.
The University of Texas, 1958

Supervisor: Professor Ira Iscoe

Despite the implicit assumption that the appreciation of humor is related to adjustment there has been very little experimental investigation of humor as an adjustment mechanism. The present study investigated the adaptive aspects of humor, hostile wit, and nonsense (harmless) wit as defined by Freud and subsequently elaborated by writers in a variety of disciplines.

Five hypotheses relevant to wit and humor were tested:

I. Groups exposed to stress conditions will appreciate wit and humor jokes more than comparable groups which are not under stress.

II. Males will appreciate hostile wit more than females, while females will prefer nonsense wit more than males.

III. Persons with large discrepancies between self and ideal scores will appreciate hostile wit more than individuals with small discrepancy scores under non-stressful conditions. When stress conditions are applied, persons with small discrepancies will then appreciate hostile wit more than the individuals with large self-ideal discrepancies.

IV. The low self-ideal discrepancy individual will have a greater appreciation for humor than will the high discrepancy person.

V. The low discrepancy individual will have a greater appreciation for nonsense wit than will the high discrepancy.

Three hundred and thirty two members of introductory classes in the behavioral sciences (196 males and 136 females) were subjects for this study.

On the first day of testing, all subjects rated themselves according to the "self" and "ideal" categories of Worchel's Self Activity Inventory. At the following class meeting, a Wit and Humor Preference Test was administered; this was developed by the present writer, with jokes judged by 11 clinical psychologists as reflecting the Freudian paradigms of these mechanisms. Stress conditions were applied by an authority figure who utilized failure-stress and insult techniques based upon the performance of the subjects on the SAI. The stress groups then rated the 30 items on the wit and humor test for appreciation. The control groups took the two tests during consecutive class periods under non-stress conditions.

Hypothesis I was not confirmed, inasmuch as the stress and non-stress groups showed no significant differences on the dependent joke variables. Hypothesis II was confirmed, with the resulting probability beyond the 0.01 level of significance.

For the three remaining hypotheses a 2 x 2 x 2 analysis of variance design was utilized, with 8 groups of 17 subjects each, differentiated on the main variables of high and low self-ideal discrepancies, sex, and stress - non-stress conditions.

Hypothesis III was confirmed for the males only. The females showed a significantly different pattern, with the low self-ideal discrepancy female appreciating hostile wit more than the high self-ideal discrepancy female under both stress and non-stress conditions. Hypothesis IV was confirmed at the 0.01 level, while Hypothesis V was rejected.

It was concluded that the Freudian distinction between wit and humor is a valid one, with wit operating as a tension-reducer under differing circumstances, depending upon the interaction of adjustment, stress, and sex factors.

The application of written humor and wit is based upon situational and personality variables and cannot be explained by single factors alone.

Future research possibilities employing both experimental and correlational methods with normal and pathological groups are discussed, as well as the utility of instruments developed in this study.

Microfilm $2.00; Xerox $4.80. 92 pages.

A STATISTICAL MODEL FOR THE PREDICTION OF HUMAN DECISION BEHAVIOR

(L. C. Card No. Mic 58-3994)

John Ernest Overall, Ph.D.
The University of Texas, 1958

Supervisor: Professor Dr. W. Lynn Brown

This dissertation presents a theory and statistical model for the decision-making behavior of human subjects. Two parameters of decision behavior are considered: 1) the average level of response probability and 2) trial to trial changes in the probability of response.

The subject in an uncertain situation is assumed to formulate a "probability hypothesis" which is an inference concerning the relative frequencies of events in the population. He continually tests his "probability hypothesis" against the relative frequency of observed events. Observed relative frequencies are expected to vary from trial to trial, and the "probability hypothesis" will be rejected only if the difference between observed and hypothesized values exceeds a critical amount. Because the subject believes his "probability hypothesis" to represent the true population value, he has "confidence" that future events will occur with a relative frequency which will not force rejection of the hypothesis. As the difference between observed and hypothesized probability values approaches the critical limit for hypothesis rejection, the subject believes that an event will occur which will restore agreement between the two.

Formulae for the prediction of trial to trial changes in the probability of response are presented. As the relative frequency of observed events increases above the hypothesized value, the probability of response to the alternative in question decreases. As the relative frequency of observed events drops below the hypothesized population value, the probability of response to the alternative in question increases. Thus, the statistical model predicts both the "probability matching" and the "negative recency effect" frequently observed in human decision behavior.

The data from five prediction-type experiments are

presented. For each experiment, trial to trial changes in the probability of response are predicted from the statistical model proposed in the dissertation. In order that the relative efficacy of predictions can be evaluated, trial to trial changes in response probability are also predicted from game theory and stochastic models. The proposed statistical model is found to predict trial to trial values of response probability with significantly greater accuracy than other models from which predictions were derived. It is concluded that the model presented in this dissertation should further the understanding of behavior in those types of situations in which "probability matching" and "negative recency" behavior occur.

Microfilm $2.00; Xerox $6.80. 145 pages.

THE EFFECT OF VALUE ON THE PERCEPTION OF DISTANCE

(L. C. Card No. Mic 58-3504)

Wallace W. Prophet, Ph.D.
The University of Florida, 1958

The purpose of the study was to investigate the role of value in the perception of distance. Five hypotheses concerning judgments of distance involving value and neutral stimulus figures were tested. The value stimuli were pairs of $1, $20, and $100 bills. The neutral stimuli were geometric figures having a configuration similar to that of the money and of identical dimensions as the money. Subjects were 27 male and 27 female students at the University of Florida. The apparatus used was a specially constructed modification of the Howard-Dolman depth perception apparatus.

Each subject made 56 judgments of the various combinations of stimuli, half under binocular conditions and half under monocular conditions. The average error and constant error were computed for the various conditions and subjected to statistical treatment. Each subject also took the Allport-Vernon-Lindzey A Study of Values. The principal results were as follows:

1. Male subjects made more accurate judgments for the value than for the neutral stimuli under both monocular and binocular conditions. No such difference was noted for the female subjects. No difference in accuracy among the three value conditions was observed.
2. Differences in phenomenal size of the various value stimuli were found to be significant.
3. Significant differences between monocular and binocular conditions were exhibited.
4. No differences between the high scorers on the economic scale of A Study of Values and the low scorers were noted.
5. The sexes differed significantly in the accuracy of their judgments of distance in the combined value vs. neutral condition.
6. The general conclusion was that value affects phenomenal size, but does not affect the accuracy of perception of distance. Microfilm $2.00; Xerox $3.00. 52 pages.

THE EFFECTS OF STRESS ON SERIAL LEARNING

(L. C. Card No. Mic 58-5484)

Alvin Jay Rosenstein, Ph.D.
University of Illinois, 1958

This study concerns the effects on learning efficiency of the degree and the temporal placement of the anxiety aroused by ego-involving instructions at various stages of acquisition. It uses changes in the palmer-sweat index (PSI) to assess the anxiety-arousing effects of the instructions, and also investigates how well a psychometric-questionnaire measure of anxiety predicts the effects of these instructions on both learning efficiency and changes in the PSI. The results obtained indicate that Ss who respond to the ego-involving instructions with much anxiety, as indicated by large PSI increments, learn more efficiently than do Ss who respond with little anxiety, as indicated by small PSI increments. No variance in learning efficiency, due to variations in the placement of these instructions in the sequence of acquisition, was found, and the anxiety questionnaire failed to show significant correlation with either changes in the palmar-sweat index or learning efficiency.

The procedure began with the administration of the Mandler-Sarason Test-Anxiety Questionnaire (TAQ) to students in introductory psychology. The 52 Ss showing high anxiety (top approximate 15%) and the 50 Ss showing low anxiety (lowest 15%) on the TAQ were then respectively assigned randomly to five experimental groups. These groups differed in the instructions given to the Ss prior to any learning trials, and after the 10th or 14th trials. The PSI was taken, first, as soon as S had relaxed in the experimental situation, and again, after S had received the instructions and learned the 13 nonsense syllables to a criterion of two errorless trials. This strategy permitted the determination of how well the TAQ would predict the effects of the ego-involving instructions both on the PSI and on trials and errors. The PSI increment served to show whether the instructions had, indeed, an anxiety-arousing effect. It also permitted relating the degree of the effects of these instructions on trials and errors to the degree of anxiety aroused, as indicated by the PSI change.

The variance found among the groups representing the various stages at which the ego-involving instructions were interjected in the course of acquisition was slight and not significant. However, anxiety as reflected in palmar-sweat increments, facilitated learning. Those Ss showing the large palmar-sweat increments required fewer trials ($P<.02$) and fewer errors ($P<.05$) to attain the criterion of two errorless trials than did Ss showing the small palmar-sweat increments. The TAQ scores failed to predict either palmar-sweat increments or the effects of the ego-involving instructions on trials and errors to criterion.

The findings that anxiety, as reflected in the palmar-sweat increments facilitated learning contrasts sharply with the finding of a marked hampering effect in a study by Beam. In Beam's study the sizes of PSI increments obtained between measures taken when Ss were learning a list of nonsense syllables under conditions without stress and when they were learning an equivalent list the day before their doctoral preliminary examination correlated .75 with increments in trials to learn. This discrepancy in results from these two experiments may be explained by either of two differences between the conditions or a combination of these differences. One differences lies in

the relationship between the anxiety-arousing situation and learning effort. In the present study the S's effort could directly modify the anxiety-arousing situation, while in Beam's study S's effort could not. The second difference concerns the fact that the ego-involving instructions in the present study yielded smaller palmar-sweat increments than did the forthcoming doctoral examinations used by Beam. An experimental design is outlined to test the relative adequacy of the two alternate explanations for these apparently contradictory findings.

Microfilm $2.00; Xerox $3.00. 46 pages.

SOME PROJECTIVE MEASUREMENTS OF THE EFFECT OF TELEVISION ON THE VALUE STRUCTURE OF THE ELEMENTARY SCHOOL CHILD

(L. C. Card No. Mic 58-5488)

Leslie William Sargent, Ph.D.
University of Illinois, 1958

Very little research effort has been spent on studies to discover the measurable effect of television on the value judgments and personality structure of children. The present study set up two matched groups of fifth and sixth grade children, one group being exposed to a large amount of television and the other group seeing none. These groups were then given a series of projective tests which would compare the verbal stereotypy, authoritarian-submission attitudes, judgment of personality stereotypes, and inner-other directedness of the TV children and the non-TV children.

The desired TV-non-TV samples were found in a group of parochial schools in California. The disadvantage of the non-typical nature of the parochial group was offset by the advantage in having a group whose mores differed sharply from those of the general population and thus, also, from the codes and stereotypes of television. The sample used in the final study consisted of 164 children (out of 220 tested) drawn from six communities scattered over northern and central California. Of this group, half came from families who did not own television and watched TV only very rarely. The other half regularly watched TV more than five hours per week, and their families had owned TV sets for more than six months. Average viewing time for the TV group was about two hours per day. These two groups were matched on a large number of characteristics. They were unmatched on televiewing and on certain reported variations in home background. Controls were set up to spot and discard any differences between the groups which could be attributed to non-television environmental variables.

Tests administered were: the Kent-Rosanoff Word Association Test as modified by Woodrow and Lowell, a modification of the Adorno F Scale, a modification of the Bank Street College Inner-Other-Directedness Scale, and the Semantic Differential. Highly significant differences between the two groups appeared on the Kent-Rosanoff Test and on the Semantic Differential. Differences on the other two tests were not clearly attributable to television influence.

When results were subjected to appropriate tests of significance the following specific differences between the TV and non-TV groups appeared: The non-TV child appears to engage in a greater variety of daily activities than does the TV child. On responses to the word association test, children in the present study appear more stereotyped than the 1916 Woodrow-Lowell children of comparable age and grades. The TV children are more stereotyped in their responses than non-TV children and omit fewer responses. On both the Kent-Rosanoff test and the Semantic Differential the TV group makes much greater use of extreme or polar responses--apparently a type of verbal inflation. This same characteristic appears when the TV group rates all tested concepts more highly on the evaluation and activity-potency scales of the semantic differential than does the non-TV group. Television children exhibit a significantly more highly valued self-concept than do non-TV children.

In general, results of the study indicate that television produces effective pressure in the direction of conformity to group norms in conduct, values, and patterns of communication. Microfilm $2.00; Xerox $6.40. 134 pages.

AN INVESTIGATION OF THE VALIDITY OF HYPNOTICALLY INDUCED VISUAL HALLUCINATIONS

(L. C. Card No. Mic 58-5508)

Harold Wayne Underwood, Ph.D.
University of Illinois, 1958

The validity of hypnotic visual hallucinations was investigated by the use of three optical illusions, in which a field of lines distorts a superimposed figure. If hallucinations actually involve perceptions similar to those aroused by objective stimulation, then a figure superimposed on the hallucinated field should appear properly distorted and the distortion of a figure in an actual field should be removed if the field is hallucinated to be absent.

Six deeply hypnotized subjects and six very deeply hypnotized subjects reported perceptions of figures projected onto a screen during hallucinated and actual presence or absence of the field on the screen. Six non-hypnotized subjects performed in the same conditions except that they imagined the presence and absence of the field and guessed the way figures would look if the suggested stimulus conditions actually existed. The results from one illusion were evaluated by contrasting the performances of the three groups; the results from the other two were to be evaluated by comparison with empirically-derived probabilities of inferring the correct responses.

1. Conclusive evidence was obtained that the negative hallucination did not measurably lessen the distorting effect of the field and thus there was no evidence for any perceptual alteration with the negative hallucination. It should not be concluded from these results, however, that no perceptual change of any kind occurs with the visual negative hallucination.

2. Conclusive evidence was obtained that for subjects who satisfy only minimal criteria for hallucinations and a deep trance, the field positive hallucination is not sufficiently like objective field stimulation to cause any measurable figure distortion. Thus, in that group there is no evidence for any perceptual changes with the positive hallucination.

3. Suggestive evidence was found that for subjects who are in a very deep trance, in which all behavior is thoroughly consistent with a deep trance and all visual hallucinations are produced with ease, the field positive hallucination does cause figure distortion which is not as great as that caused by objective field stimulation.

4. The interpretation of the results is limited by the fact that the hypnotic groups were screened from a large number of potential subjects, while the control group was selected simply on the basis of being comparable to the hypnotic groups in age and education level. It is possible that the rigid selection criteria for hypnotic Ss could have resulted in the choice of Ss who, without being in the trance, could report the figure distortions which would occur with the illusion field superimposed on the figure. In particular, subjects could have been selected who had such excellent visual imagery that figure distortions would occur simply by imagining the superimposed field.

Microfilm $2.00; Xerox $4.40. 84 pages.

SUSTAINED PERFORMANCE BASED ON SECONDARY REINFORCEMENT: AN IMPROVED METHOD WITH ADDED CONTROLS

(L. C. Card No. Mic 58-5522)

Donald Wilson Zimmerman, Ph.D.
University of Illinois, 1958

A straight-alley runway, modified by the addition of a Skinner box in place of the usual starting box, was used to study secondary reinforcement. Animals were first trained to run in the runway for food reinforcement in the goal box. A variable partial reinforcement schedule, in which the frequency of reinforcement became less and less in a random way, was used to build up the strength of the running behavior. At the conclusion of this training, the animal would promptly leave the starting box (Skinner box) and run to the runway goal box when the starting-door opened.

A bar was then inserted into the starting box, and the door was opened as a consequence of bar-pressing. From this point on, no food reinforcement was given in the runway. And, in turn, the bar-pressing was reinforced only intermittently, by the opening of the starting-door, on variable ratio and fixed ratio schedules.

Using this method, it was possible to establish and maintain a prolonger period of bar-pressing on the basis of secondary reinforcement only. Individual animals made thousands of responses over a period of from ten to fourteen daily $1\frac{1}{2}$ hour sessions and showed the characteristic performances typically generated by variable ratio and fixed ratio schedules using primary reinforcement.

While the bar-pressing behavior was being established and maintained, the runway performance began to deteriorate in a way which was similar in the case of all animals studied. Entry into the goal box first became disrupted. The animals continued to jump out of the starting box predictably, however, even after the further members of the runway chain had disappeared. Finally, the animals would jump from the goal box into the runway and "freeze" only several inches from the starting door. They held this position until picked up by the experimenter and returned to the starting box for the next cycle of bar-pressing.

As the bar-pressing sessions continued the pauses before the runs of bar responses became progressively longer. However, even in the final stages of the extinction of the performance, the local rates of responding remained consistently high.

The secondary reinforcement effects obtained in this situation, in which the secondary reinforcer (door-opening) releases pronounced discriminative behavior (running into the runway), are decidedly greater than those which have been obtained in the usual Skinner box situation.

Microfilm $2.00; Xerox $3.00. 33 pages.

RELIGION

THE CHRISTIAN PROPHETS IN THE NEW TESTAMENT

(L. C. Card No. Mic 58-5267)

Ruth Elizabeth Bowlin, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Kendrick Grobel

This study was undertaken to determine the characteristics and functions of the Christian prophets in the New Testament and their role in the early Christian Church. The significance of this problem lies in the fact that, while much study has been concentrated on the Hebrew prophets of the Old Testament, very little work has been done specifically on the Christian prophets. The main study was confined to the prophetic movement among the followers of Jesus, excluding both John the Baptist and Jesus except in regard to their fulfillment of the Jewish conception of prophecy of their day.

Since the Hebrew literary prophets are taken as the standard by which all prophets are evaluated, a background study of Old Testament prophets and the Hebrew prophetic movement was briefly sketched from about 1050 B.C. to the Christian era. The main body of the dissertation deals with the New Testament and contemporary sources.

A prophet, Hebrew or Christian, was a spokesman for God, interpreting His will and purpose for man. A prophet was also a revealer, for prophecy presupposes revelation. In the New Testament a Christian prophet was found to be a recipient of the Holy Spirit (which also characterized the Hebrew prophets), and a charismatic, having the distinctive gift of prophecy, which he was expected to use primarily in building up the Church. The use of his gift was to be both rational and restrained.

Christian prophets were leaders in the Church, having as their main function its upbuilding. They were "speakers of the word of God," leaders in the services of worship, and writers, possibly composing some of the hymns of the

Church. They were honored in the Church, but held no official position.

There are some parallels between Hebrew and Christian prophetism and some differences. Both prophetic movements declined and, in one sense, ceased, though the causes were different. Both contained apocalyptic, which arose when Hebrew prophecy ceased, but which was always present in New Testament prophecy. Both movements were dependent upon the Holy Spirit. Both contained ecstatic prophets and false prophets. Hebrew prophetism concerned the Hebrew nation; Christian prophetism concerned the Church, ministering to all peoples to whom the gospel was carried. Christian prophetism was widespread, appearing everywhere Christianity was taken.

The false prophets were a scourge to the Church, threating its well-being and the purity of its faith. In efforts to restrain them the Church extinguished the prophetic spirit itself.

The author of the Revelation believed himself to be a prophet, though technically an apocalyptist. Perhaps his claim to prophetic status rests more fully upon the prophetic values of the book.

There is a continuity in Hebrew and Christian prophetism, and they are one tradition as opposed to another. In Jesus a discontinuity appears since he belongs to both traditions but not fully to either. There is a radical distinction between the Hebrew-Christian prophetic tradition and the Hellenistic tradition. No Hebrew or Christian prophet ever believed himself to be filled with God so that he was utterly passive under the power of the Divine Spirit; in Hellenism this was the belief and the experience which was sought. Microfilm $4.65; Xerox $15.60. 364 pages.

CHRISTOLOGY AND ATONEMENT IN THE FOURTH GOSPEL

(L. C. Card No. Mic 58-5275)

Joseph Andrew Johnson, Jr., Ph.D.
Vanderbilt University, 1958

Supervisor: Professor William Kendrick Grobel

This thesis has for its problem a definition and exposition of the concepts of Christology and atonement in the Fourth Gospel. The theological concepts of Christology and atonement in the Fourth Gospel will be compared with similar concepts in the Synoptic Gospels, Pauline epistles, and the Epistle to the Hebrews. The results of this investigation will be compared and contrasted with the investigations of Christology and atonement in the Fourth Gospel made by Vincent Taylor, C. H. Dodd, and Rudolf Bultmann. A summary of the findings of this investigation follows.

(1) Christology is the religious evaluation of Jesus as Savior of men, furnishing a theological theory concerning his redemptive work. Sonship is the basic theological category for the Christological formulation of the Fourth Gospel. In the concept Sonship the emphasis is upon the uniqueness of the divine human relationship. Jesus in the Fourth Gospel is Son of Man and Son of God. Jesus as Son of Man connects the two worlds, heaven and earth, and descends to give life to the world. Jesus as Son of Man ascends again to his pre-incarnate glory. The ascent and glorification of the Son of Man are by the way of the cross. In the historical life of Jesus as Son of Man, one witnesses decisive manifestations of the glory of God in human history. Jesus as Son of Man is the place of revelation, the Way, the Truth, and the Life. Acceptance of Jesus as Son of Man demands a moral and spiritual response of the whole man to the truth that is in Jesus. Jesus as Son of God has life in himself, quickening power and authority to judge. The Son exists in the Father and the Father in the Son. Father and Son possess the power to give eternal life. The Son is subordinate to the Father in that He is sent by the Father into the world. In the life, deeds and words of the Son one will find the expression of the will of God in history.

(2) The atonement is the work of God in Jesus for man's salvation and renewal. The doctrine of the atonement seeks to answer the question, What has God done for man through Jesus? In answering this question we have rejected the methodological procedures of Vincent Taylor who imposes upon the Fourth Gospel the theology of Paul, of C. H. Dodd who gives overdue emphasis to Hermeticism, and of Rudolf Bultmann who seeks to interpret the Fourth Gospel from the point of view of Gnosticism and Mandeanism. The theological thought of the Evangelist must be interpreted in the light of the Hebraic-Christian tradition and categories of thought. The Greek influence lies on the periphery of the gospel. Soteriology precedes Christology and the most important question for the Christians of the first century was, What has God done for mankind through Jesus? The Evangelist's answer to this question is found in the "Book of the Seven Signs" (Jn. 2-12). God gives to men through Jesus for salvation and renewal healing, restoration, transformation, guidance, nourishment, enlightenment, and Life.

(3) Man appropriates the saving work of God in Jesus by believing, knowing, seeing, and hearing. Faith is the way to salvation for the Evangelist. Faith is believing that Jesus is the Christ, the Son of God. The demand of faith is that man surrender the understanding which he has of himself and submit to the absolute claims of this decisive revelation of God in Jesus.

Microfilm $5.25; Xerox $18.60. 409 pages.

A HANDBOOK FOR AREA DIRECTORS OF CHRISTIAN EDUCATION IN THE AMERICAN BAPTIST CONVENTION (BOOKS I AND II)

(L. C. Card No. Mic 58-1992)

Arthur L. Maye, Ed.D.
New York University, 1958

Chairman: Professor Lee A. Belford

Purpose of the Study

This study was conducted to supply background to the writing of a handbook for area directors of Christian education in the American Baptist Convention. The aim has been to identify principles of administration applicable in field supervision in Christian education and to ascertain duties and responsibilities, practices and procedures which are a part of the area director's job. The desire has been to provide data not only in what area directors are doing, but to give guidance in what area directors should be doing to assure an effective level of work.

Research Methods

In order to prepare the handbook, four major areas of inquiry were undertaken. The first, concerned with the identification of objectives of Christian education for children, youth, and adults, was explored through extensive study of American Baptist and interdenominational statements of objectives of Christian education. Exploration into this literature kept the conclusions of the writer in conformity with the accepted goals of Christian education, the spirit of which should permeate all that an area director does.

Two procedures were adopted for pursuing the second area of inquiry, that of identifying the principles of administration applicable in field supervision in Christian education. An intensive review of literature on the subject was foundational to a paper prepared by the investigator on principles of administration, which, in turn, was reviewed by a jury of qualified resource persons. Their criticisms led to a revision of the material and a valid statement on the subject.

Like steps were taken in the preparation and validation of a checklist for identifying the duties and responsibilities of area directors and of a questionnaire by which to elicit information about desirable practices and procedures for area directors to use. The validated checklist was sent for answer to a random sampling of lay and staff leadership representative of all parts of the country served by the American Baptist Convention. The approved questionnaire was sent for answer to all area directors serving the American Baptist Convention. The returns were summarized and used in the preparation of the handbook.

The handbook, incorporating the results of the four phases of research, was then written and appraised by ten Christian educators, selected because they met certain standards of formal study and years of experience in administration in Christian education.

Results

In its final form, the handbook followed closely the pattern of research. It consisted of the following sections: Considering the Position, Bringing Qualifications to the Position, Planning the Work, Organizing for the Work, Controlling the Work, Coordinating the Work, and Interpreting the Work. Microfilm $3.65; Xerox $12.40. 284 pages.

RELIGIOUS ENCOUNTER IN THE THOUGHT OF MARTIN BUBER AND OF JEREMIAH

(L. C. Card No. Mic 58-3117)

Robert Preston Price, II, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Paul E. Johnson

The purpose of this dissertation is to determine what takes place on the human side when a man says he has an encounter with God, with special reference to the thought of Martin Buber and of the Hebrew prophet, Jeremiah. The method has been to characterize each man's thought; to pay particular attention to the data lending themselves to psychological description, to the end of analyzing encounter with God in its epistemic, psychological and existential modes. On the basis of these characterizations, each of these men has been compared to the other to determine likenesses and differences; to assay the effect of culture at points of difference; and to summarize the points of likeness which might have abiding value.

Findings and conclusions are:

1. Buber and Jeremiah find man's essential nature incomplete apart from relation to God. Fulfilment is possible in what Buber terms an I-Thou relation--a subject-subject relation as opposed to the subject-object relation of knowledge. Subject-subject relation is made possible by a unique category of being, which Buber calls the inborn Thou. This is not to say that man has an original self. A self has to be won.

2. A sense of lack (anxiety), a reaching out, the dual gestalt of man's own being together with objective reference of the Thou, a sense of fulfilment by a Persons over against one, standing in the relation of love--these minimal elements of encounter constitute the fountainhead of religion and ethics, as well as the occasion for man's social being to emerge and to be kept intact. Revelation comes in the form of Presence--presence as power. No verbal message is given. There is a sense of reciprocal relation, of inexpressible confirmation, and of an urge to act out the power of it in the world.

3. Jeremiah conceived man to be created by God and endowed with a drive to fulfilment like the migratory instinct in birds. Man is free to direct this drive toward God and find fulfilment, or to direct it elsewhere with little promise in the face of his precarious existence.

4. For both men, one's religious knowledge and his cultural modes of thought were part of the whole person taken into encounter and could affect the subsequent interpretation of it. Neither believed that encounter was sufficient without the remainder of experience; nor did either conceive the experience of immediacy as resulting from any form of mystical absorption. Jeremiah's tribal consciousness lends itself aptly both to illustrate the limits which culture can impose on revelation and also to reveal how the Presence can transcend the limits.

5. Relation to God is necessary for maintaining the integrity of one's I; otherwise, the world of things assumes the mastery, and persons are cheapened (Buber); or man loses his moral fibre (Jeremiah).

6. Jeremiah negatively illustrates Buber's judgment that verbal messages are not given in revelation. Recently from the Presence, he put his own thoughts into the mouth of God and delivered them as a "Thus saith the Lord." The mistakes he made indicate that alleged verbal messages in revelation do not stand on their own authority. They need further testing.

7. Buber and Jeremiah found that perceptual data of religion gained in concrete life-situations were a reliable foundation upon which to build coherent religious truth. They would agree that this method of gaining religious truth has been a distinctive contribution of the Hebrew-Jewish religion.

Microfilm $2.50; Xerox $8.80. 191 pages.

THE CHURCH AND MASS COMMUNICATION

(L. C. Card No. Mic 58-5280)

James Earl Sellers, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Langdon B. Gilkey

In this post-Christian age, the contemporary recipient of religious communication is likely to lack single-minded commitment to Christian authority and at the same time, to possess many Christianized values. Consequently, the religious communicator cannot escape the problem of a relevant approach, especially in his use of the mass media, to addressees who are simultaneously "insider" and "outsider" to faith.

In his approach to the recipient as "outsider," the communicator may seek insight from the second-century Christian apologists. A study of the apologetic methods of Justin Martyr and Tertullian indicates that in the second century, the outsider is approached: (a) through personal testimony rather than mass appeals for conversion; (b) through commonly held symbols originating in the culture, which become a point of conflict as well as a point of contact. The content of apology is to announce the sinful status of every man before the Law of God, and the effect of apology is to structure pagans within a latent church.

In his approach to the recipient as "insider," the communicator may seek insight from the Reformers. Study of Luther's doctrines of the priesthood of believers and the Word, and of the rise of mass communications, shows that communication with the insider requires (a) a unifying principle, by which believers are held together in common loyalty within the church; (b) a discursive principle, drawing on the printing press and literacy, by which the believer is enabled as a person to participate in the meaning of faith, through commitment, understanding, and perusal of the written word; (c) a boundary principle, by which the believer is introduced to God's favor as redemption from his inability to fulfill the commandments.

Study of the religious communication addressed to outsiders of today shows that (a) the appeal is often no longer personal, because religious journalism, imitating the "objectivity" of commercial journalism, evinces no real commitment to the religious symbols it employs; (b) the point of contact is no longer always taken as a point of conflict, because religious communication, following the lead of commercial journalism, commonly attempts to reduce despair by the disreligious technique of allaying anxieties. Study of the religious communication addressed to insiders of today shows that (a) the unifying principle has declined, since the church's voice is now one among many, and the adherent is no longer single-mindedly oriented within a church that is a comprehensive communication center; (b) the discursive principle has declined, since the recent communications revolution has made the commicated word more a consumable commodity than an apprehendable event, leaving the individual less able to peruse and decide; (c) the boundary situation is left out of account by religious communicators, and thus the recipient tends not to listen because he no longer realizes his existential need of grace.

Following these studies, conclusions are advanced, the chief of which are: (a) the church must seek to unite communicative method and theological insight, ceasing to rely on communicators who know nothing of theology as well as theologians who know nothing of communication method; (b) the content of religious communication must take more definite account of the "human situation" and its implications.

Microfilm $4.70; Xerox $15.60. 365 pages.

AN EXPLORATORY STUDY OF PHENOMENOLOGICAL INTERPERSONAL RELATIONS

(L. C. Card No. Mic 58-5268)

Bruce Chandler Carruth, Ph.D.
Vanderbilt University, 1958

Supervisor: Professor Theodore Landsman

This study was an investigation of phenomenological interpersonal relations; that is, it was a study of relationships between persons as experienced and described by the participants in the relationships themselves. Since established research procedures for this particular problem did not exist, this investigation was devoted primarily to the exploration of methodological approaches to the subject matter. In terms of content, this research was an initial attempt to analyze phenomenological interpersonal relationships and to tentatively isolate some of the dimensions structuring that domain.

The investigation was executed in three phases. In the first of these approximately 375 persons were asked to describe the relationship each had with another person, and from them 203 descriptions were obtained. These subjects were selected from three populations: (a) the general population of adults, (b) college students, and (c) adolescents. The instructions used in obtaining the descriptions required some of the subjects to describe a "positive" relationship, others a "negative" relationship, and still others were asked to describe a relationship to a member of a specified class of persons, i.e., their relationships to parent, spouse, employer or supervisor, employee or subordinate.

In the second phase a method for analyzing the qualitative data from the subjects was developed and executed. It involved three complex steps: (a) the essays collected in the first phase were broken down into brief statements; (b) a sample of these statements were categorized by judges from the professions in the field of human relations; and (c) these categorizations by the judges were analyzed. The results of the procedure were the isolation of seven clusters of groups employed by the judges in their categorizations of the items. The items on which the judges had been in maximum agreement in assigning them to groups shown to be in the clusters were regarded as tentatively defining some of the dimensions which potentially structure phenomenological interpersonal relations.

The last phase of the research was a partial test of the usefulness of these dimensions when employed in categorizing qualitative data. The contention was made that by demonstrating the effectiveness of the dimensions as a category system for analyzing the type of qualitative data involved in this research, the method of analysis by which the dimensions were isolated would be substantiated. The results of this phase was the substantiation of four of the seven dimensions, but in the instance of the last two of these, as they are listed below, the substantiation was of a qualified nature. The success achieved in isolating these tentative dimensions is interpreted to be evidence of the effectiveness of the method by which the dimensions were isolated. This, however, was qualified by the relative inefficiency and indeterminate reliability of the method.

The four tentatively substantiated dimensions of phenomenological interpersonal relations were as follows:

The actor's feeling that the second person is dependent upon him for understand, support, and succorance.

The actor's feeling of being dependent for understanding, support, and succorance upon the second person.

The absence of conflict and a presence of understanding and agreement, as well as a similarity between the two persons in the relationship.

The affectional and sexual factor of interpersonal relations. Microfilm $3.70; Xerox $12.60. 286 pages.

A FIELD STUDY OF INDIVIDUAL CONFORMITY TO GROUP OPINION

(L. C. Card No. Mic 58-5400)

Kathryn Patricia Cross, Ph.D.
University of Illinois, 1958

Most of the research on the subject of conformity has been conducted in the psychology laboratory. Conformity patterns found under laboratory conditions may or may n not apply to the enduring social groups found in real life. It was the purpose of this study to test, in real social groups, some of the hypotheses suggested by the laboratory studies. Over 800 members of 26 national social sororities served as subjects for the test of the hypotheses.

If conformity exists in real groups, then it should be possible to measure the extent to which people show agreement with norms which are established by the group. An index of agreement with group norms was designed to give a measure of the extent to which the individual group member was in agreement with others in the group. The per cent-agreement index (%A) was based upon the percentage of the active members of the group selecting each alternative of a set of 50 multiple-choice opinion-items about local campus and sorority affairs. The %A-score for the subject was the percentage of the group selecting the same response as that which was selected by the subject. The tendency of the individual to be in agreement with the other members of the group was represented by the sum of the %A-scores for all items of the questionnaire. Results from the application of the %A scoring procedure showed that there was no consistent tendency for individuals to be "in" or "out" of agreement with the group norms. Split-half reliabilities for the score proved very low and were inadequate for the tests of the hypotheses.

An agreement score which gave credit only for agreement with the modal opinion of the group also proved

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unreliable, and it was concluded that, on the items of this questionnaire, at least, individuals showed no consistent agreement with group norms when those norms were not announced to the members of the group.

The Opinion Questionnaire was administered to the groups a second time approximately four months after the first administration. The correct modal opinion for the group was indicated on the copy of the questionnaire which each subject received. The conformity (C) index measured the extent to which the individual accepted the indicated opinions of the group. The subjects showed a consistent tendency to accept or reject the modal opinions, and the mean of the agreement with the announced norms was significantly higher than the mean of agreement with unannounced norms. It was concluded that when the norms are made known, conformity does occur in real social groups. The C-score demonstrated satisfactory reliability for tests of relationships with other variables.

Both personality and situational variables were studied for relationships to the conformity measure. The scale measuring aggression was the only personality trait measured by the Edwards Personal Preference Schedule which showed a relationship to conformity. The mean aggression-score of non-conformers was significantly higher than that for conformers when the extent of agreement with unannounced norms was low. A negative correlation between conformity and aggression reached significance at the .05 level.

The relationship between college grades and conformity was consistently negative for six groups of subjects, but the extent of the relationship failed to reach significance. Neither election to a sorority office nor the length of time as a member of the group showed significant relationships to the conformity measure. The individual's rating of the attractiveness of the group, however, was positively correlated to a significant extent with the tendency to accept the modal opinions of the group.

Microfilm $2.00; Xerox $5.40. 106 pages.

PERSONALITY AND GROUP STATUS IN ADOLESCENTS

(L. C. Card No. Mic 58-5457)

Georgia-Lee Virginia Melvin, Ph.D.
University of Illinois, 1958

This study attempts to investigate relationships between personality profiles and near-sociometric data from two points of view: from the view of group status or the receiver of choices, and from the view of the giver of choices. The following tests were given at the beginning and the end of the season at a coeducational adolescent work camp: Cattell's Sixteen PF Test, a self rating form, an ideal-self rating form, and a Manual Labor Opinion Inventory. In addition, sociometric ratings were collected four times during the summer. Four groups were selected for special study: those who increased in social status throughout the summer, those who decreased in status, those who remained highly-chosen, and those who remained relatively unchosen.

It was found that neither the group that increased nor the group that decreased in status were more homogeneous on any of the personality measures than the entire group. Neither does change in status seem to be related to change in attitude in any consistent way. The highly-chosen group is more homogeneous than the unchosen group on the ideal-self rating, and only two factors on the Sixteen PF Test differentiate the highly-chosen from the lowly-chosen. Self-ideal-self discrepancy decreases for both the increasing- and decreasing-status groups, but the number of individuals decreasing and the amount of decrease was greater for the decreasing-status group.

In the part of the study concerned with the giver of choices, it was found that an individual who keeps the same first choice throughout the summer does not become more like that person on any of the measures used in the study, nor does an individual change his first choice to someone more like him on these measures. Individuals who have mutual choices throughout the summer do become more similar on self ratings. There was no confirmation for the hypothesis that the number of times an individual changes his first choice is inversely related to his group status, but this may have been due to limitations in the data.

It is possible that the personality measures given, the method used to compute group status, and the mixture of same-sex and opposite-sex choices, have all operated to obscure some of the relationships investigated. Several suggestions are given for further studies in this area.

Microfilm $2.00; Xerox $3.00. 60 pages.

SOCIOLOGY, GENERAL

PUBLIC DECISION MAKING IN ECONOMIC DEVELOPMENT IN A SOUTHERN INDIANA COUNTY

(L. C. Card No. Mic 58-5360)

James Kenneth McDermott, Ph.D.
The University of Wisconsin, 1958

Supervisors: Professors R. J. Penn and E. A. Wilkening

Problem: Personnel of public agencies are faced with three special problems in working with lay groups in low-income areas to develop local programs for economic and community development. Such programs are required in the Rural Development program, a nationwide program designed to solve the area low-income problem in the United States.

These problems are as follows. Each area program sought is comprehensive, covering agriculture, employment, health, education and the like, not just one. Lay persons, successful though they be, are unskilled in economic analysis and planning. Finally, no emergency exists in the eyes of the people involved; a feeling of need must be created.

Procedure: A case study method was used. Data were collected in interviews with committee members, in secretary's minutes, in detailed notes of meetings, and in notes made by the researcher on problems and experiences of the group as they happened.

A three-fold conceptualization task is done. First, the social aspects of economic development are discussed, and development is related to decisions. Secondly, an economic development program urged from the outside is conceptualized as an example of linkage of social systems, and a model for decision making is presented. Finally, the evolving role of a public agency, the Co-operative Extension Service, in programs for positive economic development is conceptualized.

The report of the experience consists of a general chronology of the history of the local development-planning group and the experiences of two sub-groups working in agriculture and education.

Results and Conclusions: Conclusions from a case study are tentative. They follow.

1. Public agencies will be able to meet the new demands they face in local programs in economic development.

2. The decision-making entity must be created. The method used, to hand-pick group members, seemed to be satisfactory, but needs for training in recruiting new members and in more productive membership were indicated.

3. Three stages were identified in the life cycle of the decision-making entity--the beginning stage, the early action stage, and the early maturity stage. Demands on professional personnel are different at each stage, but sociological analysis seemed more useful than decision-making models in the action and research tasks faced in the stages the group passed through in the two-years studied.

4. The decision-making entity tended to be passive in demands for information. The group would accept and use relevant information presented to it by professionals but would seldom demand it, adding responsibilities to professionals.

5. Professional personnel needed additional training in working with groups on positive economic development. Common errors were that they expected too much from the group in terms of an orderly analytical process; they lacked skill in group techniques; they underestimated the group in terms of abilities of members and of the group's internal dynamics.

6. Indications were that the newly-created management entity did not serve as an actor in accomplishing things directly in economic development so much as it did indirectly as a reference group and advisory body to individuals who took the lead for positive economic development.

7. The taking of detailed notes which gave the number of times a member spoke and what he said was demon strated as a useful device for group work whether research is involved or not.

Microfilm $4.05; Xerox $13.80. 316 pages.

THE RENAISSANCE AND THE RISE OF MODERN SOCIAL THOUGHT

(L. C. Card No. Mic 58-5473)

Marcus Wayne Orr, Ph.D.
University of Illinois, 1958

Renaissance scholarship, in rejecting the periodic concept as basic to an understanding of western cultural developments which steadily oppose the medieval, has come to concentrate on social and economic factors as fundamental. Burckhardt's contention that the Renaissance life demonstrates continuity with modern society has been accepted by such historians as Pirenne, Schevill, and Boissonnade, who have pointed to the growth of the city, in its economic and social fact, as central to any thorough understanding of the Renaissance-modern developments. Sociologists concerned with analysis and explanation of modern culture have furnished the so-called "economic historians" with ideas and concepts which seek further to clarify the Renaissance ferment and its relation to contemporary life. However, there are theoretical gaps and inconsistencies both in the work of the economic historians and the sociologists of culture. The work of E. Jordan and E. A. Ahrens in the development and expansion of logical constructs which seek to define societal types such as spiritual, feudal, and corporate are significant contributions to cultural explanation and particularly to a clearer conception of modern society.

In its assumptions, the social thought of the Renaissance

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period is clearly rationalistic, and connects in this sense with the assumptions of much of contemporary social thought, especially as it finds expression in the work of the sociologists of art, knowledge, etc. This is evident in the attempts of such sociologists as Alfred von Martin, Arnold Hauser, and Frederick Antal to provide social justification for various aspects of Renaissance art and thought. Microfilm $2.00; Xerox $5.60. 111 pages.

AN EMPIRICAL EXPLORATION OF THE PROBLEM OF MEASURING HUMAN VALUES: A SOCIOLOGICAL STUDY

(L. C. Card No. Mic 58-5505)

Bernard Alan Thorsell, Ph.D.
University of Illinois, 1958

The ultimate task to which the sociologist is oriented in the analysis of values is the demonstration of the presence or absence of a significant relationship between human values and socio-cultural phenomena. In order for this to be accomplished, the strategy of contemporary social science calls for the development and utilization of quantitative measures of value. Two available instruments — the Paths of Life instrument designed by Charles Morris and the Adorno F-scale — purport to yield such measures. The Morris instrument deals with a positive, constructive and benevolent approach to the world, whereas the F-scale stresses a negative, destructive and malevolent Weltanschauung. Both Morris and Adorno seem to assume that such discordant views of man and the world constitute "mirror images" of each other and, as such, do not necessarily represent wholly independent value domains. In order to test this assumption, to explore the nature of the two instruments, their inter-relationship and their usefulness to the sociologist as measures of value, an empirical study of the instruments was undertaken.

The first seven "Paths" of the Morris Paths of Life instrument and Form 45-40 of the Adorno F-scale were administered to an undergraduate student population. It was hypothesized that an analysis of the results would reveal that the instruments measure values in common despite the apparent differences in their content. Data from a final N of 207 were tabulated and twenty-one variables were chosen for a statistical analysis. It was decided that factor analysis was most appropriate for this purpose because it would provide the most adequate test of the research hypothesis and of the basic value dimensions underlying the instruments. Product-moment correlation coefficients were computed for the inter-relationships between scores on the nine "hypothetical clusters" of the F-scale, the rankings of the seven Paths of Life, and scores based on the ratings of Paths of Life items which had significant loadings on five factors uncovered in a previous factor analysis of the extended form of the Morris instrument. The centroid method of factor extraction produced seven significant factors which were rotated to an orthogonal simple structure solution. The orthogonal solution was chosen because it provided the best test of the research hypothesis.

The research hypothesis was not substantiated by the results of the analysis. One clear-cut F-scale factor and five clear-cut Paths of Life factors emerged in the analysis. Only one factor carried both Paths of Life and Morris variables. This was not construed as support for the research hypothesis because this factor essentially was defined by two Paths of Life variables and the F-scale variable carried only a low negative loading. Factor scores were computed for respondents on each of the seven factors to demonstrate the usefulness of such refined measures of value in drawing a value profile for a given population. It was noted that such measures, if analyzed through the use of an appropriate clustering technique, could produce a unique value profile for the population.

It was concluded that: 1) the Paths of Life and the F-scale represent independent universes of value and meaning; 2) future work in this area should explore the hypothesis that Paths of Life items represent integration with the social order, whereas F-scale values represent alienation from the social order; 3) the two instruments can be regarded as reliable measures of value useful to the sociologist pursuing a study of values; 4) factor scores computed for basic value dimensions provide useful refined value measures.

Microfilm $2.00; Xerox $5.80. 119 pages.

THE ROLE OF NORMS IN AMERICAN CATHOLIC SOCIOLOGICAL WRITING

(L. C. Card No. Mic 58-3127)

Newell John Wert, Ph.D.
Boston University Graduate School, 1958

Major Professor: Professor Walter G. Muelder

The problem of this dissertation is to investigate the role of norms in the sociological writing of Roman Catholics in America as a case study in the general problem of ethics and the social sciences. The investigation attempts to understand the position of Catholic sociologists, criticize it, and from it draw implications for establishing a frame of reference for a coherent approach to the study of human society and its processes, which combines the empirical and the normative. The dissertation assumes that universally valid norms can be progressively known through a coherent approach to human experience. The problems of a science of man point repeatedly to the need and possibility of such an assumption. Three perspectives on norms are established, which provide the framework for the study: value-judgments about the subject matter of sociology, values as social facts to be studied, and the formal relationship between sociology and ethics. After setting forth these perspectives in a brief analysis of contemporary sociology, the Catholic development of sociology and the major issues involved in this development are analyzed. The implications of Catholic sociological work for the problem of the dissertation are set forth. The conclusion suggests an emerging point of view for a closer relationship between sociology and ethics.

Catholic sociological writing takes ethical norms seriously and has made a contribution to an understanding of the genuine philosophical problems that exist for sociology. Furthermore, Catholic sociologists have both a scientific and ethical concern which have made the problem acute.

Only recently has Catholic sociological writing passed into a phase in which sociology is being freed from the domination of philosophical and theological thought. This phase has produced a searching analysis on the part of Catholics. Almost uniformly the present solution to the problem of sociology for the Catholic is an affirmation of the needs to make biases clear and to be rigorous in both inductive and deductive methods in sociology. Catholic sociologists do not generally question the postulates of ethics. It is assumed that Catholic ethics are normative in the realm of values. At this juncture in the development of sociology among Catholics it appears that sociology is not conceived of as playing a dynamic role in the validation of norms. While such writing may treat norms functionally, this is to a limited degree because the ends of ethics are latent. The functional role is not thoroughgoing in the sense of providing material for the validation of norms.

This study does not suggest that sociology assume the ethical task, but the criterion of coherence in orderly thinking requires that all experience be related synoptically in the discovery of truth. A more inclusive sociology is needed, freed of both absolutistic and relativistic biases which beg ethical questions. It is further suggested that sociology enter more vigorously into the dialectic that a coherent approach to truth implies.

Microfilm $3.15; Xerox $10.80. 242 pages.

SPEECH—THEATER

A SUGGESTED PROGRAM FOR A THREE-YEAR COURSE IN SPEECH FOR A SENIOR HIGH SCHOOL: A STUDY TO DISCOVER THE SPEECH NEEDS OF A SELECTED HIGH SCHOOL AND SUGGESTIONS FOR SOLVING THE PROBLEMS INVOLVED

(L. C. Card No. Mic 58-1983)

Anne V. Bailey, Ed.D.
New York University, 1958

Chairman: Professor Dorothy I. Mulgrave

The purpose of this study is to prepare a program in speech for a three-year senior high school. The secondary school selected as the basis of the research is situated in an industrial area in New Jersey; and it offers a curriculum organized for the sophomore, junior, and senior years to the girls in the community.

Before preparing the program, it was necessary to discover the actual speech needs of the school. To do this, five specific areas--the students' needs and interests, the present resources of speech education at the school, the philosophy and objectives with special reference to speech, the kind and extent of a speech program in selected high schools in the United States, and the type and degree of speech programs in selected high schools in New Jersey--were investigated. The research was carried on for the most part by questionnaires; but, in some instances, the personal interview was used. Because the students' needs and interests were broad in scope, this area was divided into five subdivisions to help conduct a more thorough investigation. The subdivisions consisted in a study of a questionnaire submitted to one third of the student body, an evaluation of the groups and agencies outside of the school that influenced it, a review of the information afforded by the guidance department concerning the background of each one enrolled and her future plans, the postgraduate speech needs of the student, and evaluation of taped readings indicating present voice patterns.

The high schools selected from all areas of the United States were chosen as having representative speech programs. These were used as the foundation for a "model" program in speech, which, in turn, was the guide in constructing the suggested one.

The results of the investigation showed that speech curriculums on the whole in high schools of the United States, and particularly in the selected school, are inadequate. A lack of knowledge concerning the place of the speech arts in the student's development by those concerned is indicated as the fundamental cause of this inadequacy. However, personnel directors in business and industrial firms, and chairman of departments of English in post-graduate schools who expressed their opinions believed that their candidates should have more speech training during the preparatory years. The investigation of the students' backgrounds, their present programs both in and outside of school, and their future plans indicated the need for greater emphasis on speech training.

Using the results of these findings, an enlarged speech program comprising required courses in fundamentals and public speaking, and an elective course in drama has been developed. Microfilm $2.80; Xerox $9.60. 215 pages.

AN EXPERIMENTAL STUDY OF THE INTELLIGIBILITY OF ALPHABET LETTERS

(L. C. Card No. Mic 58-5413)

Thomas Holland Fay, Jr., Ph.D.
University of Illinois, 1958

This study was designed to gather certain basic information about the gain functions of the alphabet letters, individually and pooled. Randomly ordered recordings of the letters from three superior speakers were presented at various sound pressure levels to groups of normal hearing listeners. The resultant responses were analyzed by letters, speakers, and listeners and compared to physical measurements of the recordings. Within the procedural limits of the study the conclusions are as follows:

1. There were significant differences between letters, between speakers, and between listeners with levels pooled. In addition the speaker by letter interaction was significant.
2. The gain function of the alphabet letters, when pooled, fell within the range of slopes previously reported and is most similar to the monosyllabic PB word lists.

3. The slopes of the individual letters ranged from values lower than any previously reported in the literature to values considerably higher than those reported for speech materials. This finding attests to the heterogeneity of the letters.

4. The 50% identification levels of the letters were found to differ widely and these differences were not attributable to variations in level of utterance. Equating the letters for differences in 50% level resulted in a steeper gain function for the pooled letters.

5. The several measures of intelligibility, i.e. percent correct, slope, and 50% level, were highly related to each other, but appeared to bear little relation to measures of RSP and duration.

6. The various measures of intelligibility tended to group the letters according to the eight common vowel components. The groups arranged in order of high to low intelligibility were /o/, /ɑr/, /aI/, /dʌbljʊ/, /ɛ/, /e/, /ju/ and /i/. The rank orders of these groupings did not appear to be strongly related to the number of letters sharing a common vowel component.

7. The /o/, /ɑr/, /aI/ and /dʌbljʊ/ groups demonstrated relatively high intelligibility and should be excluded from lists intended for use in discrimination testing. Most of the /e/ and /ɛ/ letters were more similar to the /ju/ group than they were to /o/, /ɑr/, /aI/, and /dʌbljʊ/. The groups showing the greatest similarity were /i/ and /ju/.

8. The alphabet letters, with the exception of I, O, R, W and Y, appear applicable to a hearing test with wide clinical application. Microfilm $2.00; Xerox $4.20. 76 pages.

A CRITICAL EDITION OF RICHARD SHERRY'S A TREATISE OF SCHEMES AND TROPES

(L. C. Card No. Mic 58-5347)

Herbert William Hildebrandt, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Frederick W. Haberman

Richard Sherry's Treatise of Schemes and Tropes, 1550, is an extremely rare text, is difficult to read because of its antiquated typography, and has never been thoroughly analyzed. Thus, the reasons for this dissertation are twofold: first, to analyze the position of the Treatise in rhetorical history, and second, to make available a modern edition of the work.

To fulfill these objectives, the dissertation is divided into two parts. Part One, in the form of an Introductory Essay, tries to meet the first purpose in four major sections. Section one constructs the life of Sherry and reviews his two non-rhetorical works. Section two is a detailed analysis of the Treatise, and includes, one, Sherry's reasons for writing the work and a brief analysis of its contents; two, sources to which Sherry turned in collecting his schemes and tropes; three, a comparison of the Treatise with contemporary stylistic rhetorics; and four, a discussion of the possible reasons for appending the long Erasmian oration to the Treatise. Section three compares the Treatise with Sherry's second stylistic rhetoric, the Treatise of the Figures of Grammar and Rhetoric. Section four attempts to place the Treatise more precisely than heretofore in the rhetorical history of the age. The final section of Part One is a detailed discussion of the methodology employed in modernizing the Treatise. Appended to Part One is a section providing in parallel columns additional evidence on Sherry's dependence in writing his Treatise.

Part Two tries to meet the need for a modern edition of the Treatise. This edition of the text is based on the Henry E. Huntington Library copy collated with four other copies to assure accuracy. There has been no change from the original text other than in typography. All oddities of orthography, punctuation, and wording are retained to keep as much of the flavor of the 16th century as possible. The text appears on the recto and the textual notes are interleaved on the verso. Introductory to the text in Part Two is an analytical outline of the work. Following the text are general notes which explain complex meanings, trace allusions, and translate foreign terms.

Sherry's Treatise contributes little originality to the renaissance concept of style. It carries forward many of the identical figures, definitions, and examples found in Sherry's four major sources, Mosellanus, Erasmus, the author of the Rhetorica ad Herennium, and Weltkirch, as well as three minor writers, Donatus, Castellion, and Linacre. In contrast to stylistic rhetorics contemporary with the Treatise, it is not as elaborate in organization and detail, but it does not veer from their basic philosophy that Englishmen should rise above the rough idiom of common speech when employing their native language. In this Sherry is a perpetuator rather than an originator.

But to evaluate Sherry entirely on the criterion of originality is to overlook a significant contribution which he made to the history of rhetoric. Sherry's Treatise has merit because up to 1550 the world knew the figures primarily in Greek and Latin; now in the Treatise they became available for the first time in English.

Sherry was concerned with what he called the "ornate" and the "eloquent." And by these terms and their connotative meanings, he may have felt that the figures, used ornately and eloquently, could in some measure meet the deficiencies of the English language which at this time was crude, narrow, and rudimentary in expression. Schemes and tropes were to be the machinery which could assist the 16th century Englishman to rise above the common by lending vividness, clarity, and flexibility to the expression of his ideas. Microfilm $6.15; Xerox $21.80. 484 pages.

AN EXPLORATORY STUDY OF DIPHTHONG FORMANTS

(L. C. Card No. Mic 58-5434)

Anthony Holbrook, Ph.D.
University of Illinois, 1958

Although vowels have been studied extensively, the experimental literature reports comparatively few investigations of the acoustical characteristics of diphthongs. The present experiment explored the utterances of General American speakers. Six diphthongs and ten vowels were spoken in words by 20 young, male adults. The frequencies and amplitudes of the lower three formants were measured, with the following major findings.

1. Durations of the formants were relatively short in /eɪ/, /oʊ/ and /ju/, longer in /ɑɪ/, /ɔɪ/ and /ɑʊ/. Formants One and Two coincided approximately throughout except in /ju/, where Formant Two tended to be shorter than Formant One and to be discernible during the first two-thirds of the utterance only. Formant Three started comparatively late in /oʊ/ and /ɔɪ/. It subsided before the ends of /ʊ/ diphthongs, but tended to persist to the ends of /ɪ/ diphthongs.

2. F_1 and F_2 diverged during their course in /eɪ/, /ɑɪ/ and /ɔɪ/, tended to maintain a constant ratio as both lowered during /oʊ/, and converged during /ɑʊ/ and /ju/. The rate of change of F_2 accelerated in the last half of /ɑɪ/ and /ɔɪ/. A_1 and A_2 tended to increase slightly at first and to decrease thereafter, becoming lower at the end than at the beginning. A_3 appeared to be capable of differentiating classes of diphthongs, being prominent in /ɪ/ diphthongs, weak in /ʊ/ diphthongs.

3. Coordinate plots of F_1 and F_2 revealed extensive overlap among the diphthong areas, but lawful relationships were apparent.

4. Only one formant could be identified in the lower frequency range of some samples of /ɔɪ/ and /oʊ/ during the early portions of their durations.

5. In /eɪ/ and /oʊ/, the rate of change of F_1 and F_2 was fairly regular, but in /ɑɪ/, /ɑʊ/ and /ɔɪ/ about two-thirds of the frequency change occurred in the last half of utterance.

6. In relationship to the locations of vowels in the F_1 and F_2 coordinate plane, /eɪ/ started in the proximity of /ɛ/ and ended close to /ɪ/; /ɑɪ/ and /ɑʊ/ started between /æ/ and /ɑ/, with /ɑɪ/ ending close to /ɛ/, and /ɑʊ/ close to /ɔ/; /ɔɪ/ started near /ɔ/ and ended close to /ɛ/; /oʊ/ also started near /ɔ/, passed through /o/ about midway in its course, and ended near no vowel; /ju/ started between /i/ and /ɪ/ and ended near /ʊ/.

7. Coordinate plots of F_1 and F_2 showed extensive overlap of vowel areas, but the areas were mutually exclusive when the 10 samples closest to the median were considered. The findings were in general agreement with those of earlier measurements. In some of the /ɔ/ samples, only one formant was identified in the lower frequency region.

8. A_3 in front vowels exceeded A_3 in back vowels; within either class, A_3 tended to increase from high to low. Back vowel spectra were steeper than those of corresponding front vowels. Microfilm $2.00; Xerox $4.80. 95 pages.

THE LINCOLN-DOUGLAS DEBATES OF 1858: A PRESENTATION OF THE RHETORICAL SCENE AND SETTING WITH A PILOT FILM SCRIPT OF THE OTTAWA DEBATE

(L. C. Card No. Mic 58-5440)

Harriet Patricia Jordan, Ph.D.
University of Illinois, 1958

This study provides an example of the way in which one factor of rhetorical criticism--the scene and setting--can be presented through the video-audio medium of film for use on television or other film projection methods.

My thesis is that the scene and setting of speeches can be presented visually, on film, in a manner which observes and illustrates standards of rhetorical criticism. The thesis is developed not by argument, but by demonstration.

The subject for the demonstration is the Lincoln-Douglas debates of 1858. Since the scene factor is of primary concern, the language of the debates is considered only in its relation to the scene which supports it. A sample script illustrates the way in which film presentation can be made.

The object of the sample script is to present the scene of the Lincoln-Douglas debates of 1858. There were seven debates in the series undertaken by Lincoln and Douglas. For the purpose of the thesis the scope of the sample script touches upon the essential history of the period, the emergence of slavery as a political issue, the scene and setting of the debates as a whole and of the first debate at Ottawa.

The selection of the scene components of the script was governed by an analysis of the scene of the debates and the relationship of this scene to the other elements of the event according to Kenneth Burke's standard of criticism--the "dramatistic pentad."

Burke's pentad stipulates five concepts: act, scene, agent, agency, and purpose. In this study, the act is the series of seven debates; the "scene," the when and where of the debates, is the year 1858 and the locales of the various debates; the "agents" are Abraham Lincoln and Stephen A. Douglas; the "agency" is the spoken word; and the "purpose" of the act is the winning of the senatorial election in Illinois in 1858. Consequently, the set of co-ordinates which governed the selection and presentation of the materials of the script--both its linguistic and visual components--were as follows:

I. Scene-act relationship--How did what was done, the debates, grow out of the times and places in which they took place?

II. Scene-agent relationship--How did the times and places of the debates relate to the agents, Lincoln and Douglas?

III. Scene-agency relationship--What characteristics of the times and places of the debates made them effective?

IV. Scene-purpose relationship--What unique characteristics of the times and places of the debates aided in the success or failure of the campaign?

Lincoln's "House-Divided" speech has been used as a unifying component in the script. It is used to establish the subject of the script and to lead into all other parts of it--the scene of the speech itself, which was the beginning of the campaign for Lincoln; the history of the slavery question up to the year 1854; the history of the Kansas-Nebraska Bill of 1854; the history of the Dred Scott decision of 1857; and the debates themselves. A portion of the speech is used also as the closing of the script, so that through the words of the speech, which begins the narrative, one sees the meaning, implication, and history that support the message.

By adapting the format of the script to the available historical evidence, historical accuracy has been maintained. This accuracy has been further supported by proper and authoritative documentation in addition to the rhetorical analysis upon which the content of the script is

based. Authentic photographs and drawings appended to the script provide a basis for authentic production.

Microfilm $2.35; Xerox $8.20. 179 pages.

McVICKER'S THEATRE, 1857-1896

(L. C. Card No. Mic 58-5448)

Jay Ferris Ludwig, Ph.D.
University of Illinois, 1958

This is a study of the theatrical management of James H. McVicker at his theatre in Chicago from 1857 to 1896. The policies and procedures of McVicker in the management of his theatre are outlined and related to the larger picture of theatre in Chicago and in the country as a whole.

Contemporary Chicago newspapers were the chief source of information.

The background to McVicker's managerial career is presented in Chapter I. For convenience, the thirty-nine year history of McVicker's Theatre under his management is divided into three periods: Chapter II, The Beginning to the Great Fire, 1857-71; Chapter III, the Rebuilding to the Demise of the Regular Stock Company, 1872-79; and Chapter IV, As a Combination House, 1879-96. The high points of each period are summarized; then the physical structure of the theatre, the plays presented, the production policies, and the position, influence and business methods of McVicker are examined. A summary of McVicker's policies and procedures in relation to contemporary theatrical practice concludes this study.

During the years from 1857 to 1871 the caliber of McVicker's stock company and of the traveling stars was generally high. McVicker was conscientious in preparing settings for his plays; he always employed capable scene-painters. From forty to seventy percent of the plays presented at McVicker's Theatre were contemporary melodramas. From ten to twenty percent were standard plays. The major change in the type of plays produced was the gradual disappearance of the farce. McVicker's 1857 theatre was the largest Chicago had ever seen. In 1865 the theatre underwent extensive renovation and in 1871 it was rebuilt. During the 1857-71 period, McVicker established his position as Chicago's leading manager. Not only did he keep his theatre in good condition and present carefully produced plays, but he also functioned as a responsible citizen.

McVicker was criticized for the poor caliber of his company in the period 1872 to 1877, and he attempted to fight the combination system in 1877 by hiring an excellent company and operating without stars or combination companies. He was unable to sustain the cost, however, declared bankruptcy in 1878, and disbanded his permanent company on May 10, 1879. He was the last of the Chicago theatre managers to do so. From 1879 on McVicker operated his theatre as a combination house.

James H. McVicker's significance lies in his position as a typical first-class manager outside New York City His career reflects certain changes which were typical of theatre throughout the country: the change from nightly or bi-nightly changes of bill to the long run; the disappearance of the afterpiece and the short farce; the rise of spectacular realistic scenery and the growing demand of audiences for "realism" in setting and costume; the growth of the stage house and the disappearance of proscenium boxes; and the change from the permanent resident company to the traveling combination company. McVicker's summer revivals of resident companies during the late eighties and nineties are early examples of summer stock, the only form in which the resident stock company has survived. Finally, and most importantly, his career spans the turbulent period when theatrical control was slowly centering in New York and when independent theatrical activity in all other cities was being snuffed out. The career of McVicker--his early years as a creative theatre artist and his gradual decline to the rank of "janitor"--reflects that development, furnishing a concrete illustration of the reduction in status of the provincial theatre manager in America.

Microfilm $2.00; Xerox $7.00. 148 pages.

THE DEBATES ON THE WAR OF 1812: PARLIAMENT AND CONGRESS COMPARED

(L. C. Card No. Mic 58-5480)

Clyde Elwood Reeves, Ph.D.
University of Illinois, 1958

The first part of this study contains an introductory chapter and one on the background of the conflict. The second consists of three chapters titled The Pre-War Debates, The War Debates, and The Peace Debates, covering a period between February, 1812, and April, 1815. In each of these chapters the cases and methods used in debating international issues by speakers in the British Parliament are first analyzed, then those in the American Congress are analyzed, and finally the two are compared for significant similarities and differences. The conclusion makes overall comparisons of the debating in both nations in all three periods, and summarizes the findings.

The most used type of reasoning in both nations was the causal relation. In support, the backers of both Governments tended to rely mainly on broad assertion backed only by further assertion, whereas Opposition speakers tended to support their causal relations with other forms of reasoning, notably inductions. Inasmuch as Opposition's evidence was more plentiful as well as more specific and concrete, their inductions were likewise more solidly established than those of the Governments which, when used, tended generally to be enumerations at relatively high levels of abstraction. In both countries there was a considerable use of evidence from the "enemy", with the British Opposition making the most extensive and effective use of it against their Ministry.

Although American Government defenders did become vulnerable to charges of inconsistency late in the war, in the early and middle phases they exhibited probably the best "pure" debating of the deductive sort, internally consistent and free from contradictions, in their dialectical exploration and testing of the disputed principles in the impressment conflict. At the other extreme, defenders of the British Government seem throughout to have engaged in more palpable rationalizing as evidenced by frequent internal contradictions and inconsistencies.

Except for a striking refutation by American Government

spokesmen in the Peace Debate, the better refutation was consistently done by Opposition speakers. The most used refutative device was the exposing of inconsistencies. Notable in proving inconsistencies were the a fortiori analogy, contradictory statements from the public records by the same men at different times, turning the tables, the reductio ad absurdum, and the dilemma. These devices frequently appeared in various combinations.

In general, Government backers chose to refute their Oppositions with the power of the vote rather than the powers of the spoken word. Speakers of the British Opposition were more successful than their American counterpart in overcoming by debate their Government's parliamentary advantage.

Basically the similarities in the debating outweigh the differences which seem to be attributable in part to structural and procedural differences between the American and British legislative bodies, in part to the nature of the motions under debate and the specific objectives desired, and largely to differences in the availability, at the moment, of the various means of persuasion to the various factions involved. Microfilm $2.30; Xerox $8.20. 176 pages.

ZOOLOGY

THE EFFECT OF P-32 IRRADIATION ON THE ECTODERMAL AND MESODERMAL COMPONENTS OF THE DOWN FEATHER IN THE CHICK

(L. C. Card No. Mic 58-3867)

Russell Conklin Faulkner, Jr., Ph.D.
The University of Oklahoma, 1958

Major Professor: Richard A. Goff

Fertile White Leghorn eggs were incubated for a period of ten days at which time approximately 500 microcuries of P-32 were injected into the amniotic cavities of the developing embryos. These embryos were allowed to continue incubating through the fourteenth day. At this time they were sacrificed, fixed, and stored. Control embryos were of two classes, those which were allowed to incubate without disturbance, and those which were treated as the experimentals except that ordinary phosphorus was injected. Both classes of controls were sacrificed at half day intervals beginning on the tenth through the fourteenth day.

General observations revealed an overall reduction in size of the experimental embryos as was indicated by an average loss of weight as compared with controls of the same incubation period.

It was also observed, when embryos of equal wing length were compared, that those of the controls came from embryos 1.05 days younger than the experimentals. This indicated a retardation of growth of the experimental wings.

Retardation of growth was further demonstrated when the second primary down feather germs were removed intact from the wings of all three classes and measured. By using the wing lengths of the controls to represent age groups the percentages of feather germ length to wing length were plotted on a graph and the germs from the experimentals were found to be much shorter, on the whole, than germs from controls with similar wing lengths. No significant differences were found to exist between the two control groups. Retardation of growth was attributed to irradiation.

Transverse serial sections of the feather germs were made and studied microscopically. The microscopic examinations of the two components of the germs confirmed the general observations that the germs were differentially retarded by or were specifically sensitive to the irradiation.

All down feather structures, barbs and barbules, arise from the ectodermal component. This component is a region of organization, and various degrees of organization in experimental germs were observed although chronologically the embryos were the same age. The pulp is composed of undifferentiated cells and capillaries. Microscopic examination revealed that when the pulp was most affected by irradiation, the ectodermal component was likewise most affected. This was attributed to irradiation effect on the blood vascular system.

Cytopathological conditions were edema, shrinkage, vacuolated cytoplasm, vesicular nuclei, clumped chromatin, and pycnosed and crenated nuclei. Mitosis, which was confined to the bases of the germs, was retarded but not completely inhibited. There was a marked decrease in cell numbers in the experimental germs which was attributed to retarded mitosis and cell death. Hemorrhaging was observed in some germs but was not attributed to direct irradiation effect.

Microfilm $2.00; Xerox $3.00. 55 pages.

STUDIES OF THE PHYSIOLOGY OF WINTERING AND OF MOLTING CANADA GEESE (BRANTA CANADENSIS INTERIOR)

(L. C. Card No Mic 58-5425)

Harold Carsten Hanson, Ph.D.
University of Illinois, 1958

A tenfold increase in the numbers of Canada geese wintering in Illinois between 1945 and 1954 emphasized the need for research on the relationship of physiological factors and condition in these birds ro refuge management and various kinds of stress. Particular emphasis was given to comparisons of wintering and of molting geese in respect to body weight, weight of pectoral muscles, organ weight, blood constituents and changes in the histology of the femur. Body growth in goslings and growth of the wing primary feathers both in goslings and older geese was also studied.

Immature geese gradually increased in weight during the November-January period. Data are less complete for February and March, but a slight decline in weight was indicated during February, followed possibly by a slight increase in March prior to migration. Yearling and adult geese exhibited no consistent pattern of weight change during the winter period. In winter, yearling geese weighed approximately a pound (400-488 grams) more than immatures; adult geese averaged approximately a third of a pound (130-150 grams) more than yearlings. Body weight in all ages of geese was affected from year to year by the abundance of food on the State refuges relative to the number of geese using these refuges. The average body weights of immature geese wintering in 1957 at two refuges only 15 miles apart differed as much as 225-275 grams (0.5-0.6 of a pound) due to differences in the relative abundance of food.

Growth of the average primary feather in goslings proceeded at the rate of 1.7-1.8 per cent per day; in an adult male the rate was 2 per cent per day. Average increase in the length of the primaries in adults was 7 mm. per day.

Heart weight increased with age, but a relative increase was indicated only in the case of adult males; heart weights showed a significant correlation with body weight. The combined weights of gizzard and proventriculus showed no significant correlation with body weight, but the relative weight of these organs exceeded that reported for chickens or turkey. Liver weights of immatures relative to body weight were significantly higher than in yearlings and adults. A decrease in pancreas weights with age was indicated in both sexes, but the differences between age classes were not significant. Spleen weights decreased markedly and significantly with age in females; in males, the average weight of the spleen was higher in immatures than in older geese, but the difference was not significant. Average weights of testes and ovaries were significantly lower in molting geese than in wintering geese. Thyroid glands of adult geese in winter were significantly heavier than those of immatures; no significant differences were found between wintering and molting geese. The adrenal glands of molting yearlings and adult geese were significantly lower than those of wintering geese.

Serum calcium levels were higher and plasma protein levels lower in molting geese then in wintering geese. Inorganic phosphorus levels and components of the plasma protein varied with age, and the latter between molting and nonmolting geese. No important differences in serum sodium or serum potassium levels were found due either to age, sex or the molt.

Both anatomical evidence and biochemical considerations provide a basis for the concept that in the fasting goose, muscle tissue must be degraded to provide oxalacetate, the catalyst requisite for the utilization of depot fats. Adequate protein stores, i.e. muscle tissue, appear, therefore, to be nearly as important as fat stores for survival in time of inadequate food intake. While molt represents a heavy stress, its chief physiological characteristic is a deficit nitrogen balance.

Microfilm $2.00; Xerox $6.00. 125 pages.

SOME ASPECTS OF THE DEVELOPMENT AND THE ECOLOGY OF THE PELAGIC PHASE OF THE GRAY SQUETEAGUE, CYNOSCION REGALIS (BLOCH AND SCHNEIDER) IN THE DELAWARE ESTUARY

(L. C. Card No. Mic 58-5287)

Jay L. Harmic, Ph.D.
University of Delaware, 1958

Collections of eggs and larvae were made at various stations and at different depths in the Delaware River estuary during the spawning seasons of 1955, 1956, and 1957. Analysis of the collections indicated that the gray squeteague, Cynoscion regalis (Bloch and Schneider), utilized most of the bay for spawning as eggs of this species were found in collections from the mouth of the bay to the Smyrna River. The greatest spawning activity, based on the number of eggs found, was the southwestern part of the estuary. The spawning season of the gray squeteague was found to extend from late May until early August with the principal production of eggs in the latter part of June and the latter part of July. Eggs and larvae were found in waters with temperatures ranging from 17.0° to 26.5° C. and in water of salinities from 12.05 to 31.13 parts per thousand. Identification and aging of eggs during development were based on a reference collection prepared as a part of this study. By means of this collection the morphometric and embryological characteristics of the gray squeteague egg were described and various measurements were recorded from the eggs and the newly hatched larvae.

Laboratory propagation experiments were carried out to determine the upper and lower limits of survival for temperature and salinity. Gray squeteague eggs hatched after approximately 1,000 degree-hours in the laboratory experiments. Some hatching occurred in waters with salinity values ranging from 12.00 to 32.50 parts per thousand and temperatures ranging from 12.0° to 31.5° C. Optimum hatching took place between 18° and 24° C. Laboratory experiments employing sudden temperature and salinity changes of the magnitude encountered in the Delaware River estuary were found to be capable of drastically reducing the percentage of eggs hatching.

Mechanical injury and subsequent failure of the eggs to hatch as a result of turbulence produced experimentally demonstrated the possibilities of mass mortality of eggs and larvae in the estuary as a result of storms. Deficiencies of dissolved oxygen lowered the success of hatching. The addition of a mixture of 25 parts per million each of penicillin and streptomycin to the water in which the eggs were developing increased the success of hatching approximately four times. Seventy-five parts per million of either of these used alone was toxic. No difference in hatching success was obtained when eggs were propagated in constant darkness or constant light.

The ranges of salinity and temperature found in the laboratory suggest reasons for the distribution of spawning in the estuary. Most of this activity and subsequent development of eggs in the estuary falls within the ranges found to be optimum in the laboratory experimental work. This study concludes that the gray squeteague difinitely spawns in the estuary. Because of the rapid rate of development the eggs collected in the bay could not have been carried in on tidal currents before hatching occurred. Collections in the tributary rivers indicated that no spawning took place there and that eggs were not being washed in from

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

the tidal streams. The frequent variations in salinity or temperature, or the occasional extreme turbulent conditions that occur within the Delaware River estuary could have a distinct effect on the success of a year class of the gray squeteague. This may be an explanation for the fluctuating character of the fishery and the information may be useful in the future management of the gray squeteague in the Delaware River estuary.

Microfilm $2.20; Xerox $7.80. 168 pages.

THE ECOLOGICAL DISTRIBUTION OF BATS IN FLORIDA

(L. C. Card No. Mic 58-3494)

William Lamar Jennings, Ph.D.
The university of Florida, 1958

The distribution of the 15 species of bats found in Florida was investigated. The factors affecting each species were discussed. Data on geographic range, life history, regional abundance, habitats, mortality rates and migration taken from the examination of more than 5000 specimens collected in various ways were presented. Maps were included to show the abundance of each species in various parts of its Florida range.

Some bats are influenced by the distribution of plant communities but availability of roosting sites was more important for several species. A correlation was observed between roosting habits, mortality rates and the number of young in litters.

Microfilm $2.00; Xerox $6.40. 135 pages.

A BIOGEOGRAPHIC STUDY OF THE HERPETOFAUNA OF EASTERN TENNESSEE

(L. C. Card No. Mic 58-3495)

Richard M. Johnson, Ph.D.
The University of Florida, 1958

The study area is eastern Tennessee from the western escarpment of the Cumberland Plateau eastward to the Tennessee-North Carolina state line along the summits of the Unaka Mountains, and from the Tennessee-Kentucky state line on the north to the Tennessee-Georgia state line on the south.

Nineteen species of salamanders (excluding the subfamily Desmognathinae), 15 species of anurans, 11 species of turtles, 8 species of lizards, and 22 species of snakes are reported as occurring in eastern Tennessee. The taxonomic allocation of each series is based upon a comparison of the material with taxonomic descriptions in monographs and references. In several instances, the specimens are compared with series of identified material in the University of Florida Collections. When material from eastern Tennessee differs from taxonomic descriptions and is difficult to identify taxonomically, this is emphasized in the account of the species to which the material is tentatively allocated. No attempt is made to redefine or to refine the existing taxonomy of the species encountered. Reporting the occurrence of Scaphiopus h. holbrooki, Graptemys p. ouachitensis, Coluber c. flaviventris, Natrix s. pleuralis, Diadophis p. punctatus, and Elaphe o. spiloides in eastern Tennessee constitutes extension of the known ranges of these forms. Evidence also indicates that eastern Tennessee is in the zone of intergradation among subspecies of 3 species of salamanders, 2 species of anurans, 4 species of turtles, and 6 species of snakes. The taxonomic discussion of each form includes remarks concerning the known horizontal and vertical distributions of the various amphibians and reptiles.

Intraneous, extraneous, and endemic forms are recognized among the elements of the herpetofauna. These three categories are based upon the spatial relationship between the occurrence of the various amphibians and reptiles in eastern Tennessee and the remainder of their known ranges. There are 52 extraneous forms; 19 with northern affinities, 21 with southern affinities, and 12 with western affinities. Intraneous forms total 30, and endemic forms 13. Most of the western extraneous forms are confined to the Cumberland Plateau and to the southern part of the Valley Province. Their occurrence in eastern Tennessee is attributed to factors prevailing during the postglacial xerothermic period. Most of the southern extraneous forms are confined to the southern part of the Valley Province and to the lower slopes of the Unaka Mountains south of the French Broad River. Two salamanders, 1 lizard, and 1 snake are practically confined to these lower slopes of the mountains. The apparently anomalous restriction of southern amphibians and reptiles to the mountain province is attributed to the climatic conditions on the lower slopes, especially the high summer precipitation. The northern extraneous elements are most numerous in the Cumberland Mountains, the northern half of the Valley, and in the Unaka Mountains between elevations from 2,500 to 5,000 feet. Only one northern extraneous form occurs above an elevation of 5,000 feet. Intraneous elements occur throughout eastern Tennessee, except that only three (viviparous snakes) occur at elevations in excess of 5,000 feet. Of the endemic species, only three are found outside the Unaka Province.

Differentiation of certain endemic salamanders is explained in terms of the isolation of ancestral populations at high elevations during the xerothermic period. The distribution of the endemic turtle P. s. troosti is explained as the result of separation of ancestral populations during maximum glaciation.

As a result of this study, division of eastern Tennessee into four herpetofaunal areas is proposed. The basis for this proposal is the vertical and horizontal distribution of the herpetofaunal assemblages. Vegetation and climate are also employed in defining the areas. The areas are not coincident with physiographic features.

Microfilm $3.00; Xerox $10.40. 231 pages.

THE BIOLOGY OF THE EASTERN FENCE LIZARD, SCELOPORUS UNDULATUS HYACINTHINUS

(L. C. Card No. Mic 58-3978)

Joseph Patrick Kennedy, Ph.D.
The University of Texas, 1958

Supervisor: Dr. W. Frank Blair

A population of the eastern fence lizard, Sceloporus undulatus hyacinthinus inhabiting a 4.5 acre tract near Dallardsville, Polk County, Texas, was studied during the two year period January, 1956 - January, 1958 to determine the populational biology of this species.

In this study a total of 811 lizards were marked and observed data from field study were recorded. Fence lizards are active throughout the year in eastern Texas and are forced into temporary quiescence only during occasional cold weather. Average home ranges were determined. Males have larger home ranges than females in both the young and adult stages. Daily activity patterns and sleeping habits were observed. Chance meetings of adult males usually result in combat. Females were not observed to engage in combat. The breeding system is polygamous with a male usually found in close association with the females within his range. Pairing is most frequent during the breeding season of early spring to midsummer when a male may be seen in association with a female and occasionally with more than one female. The gestation period was not well determined but appears to be about 4 - 6 weeks. A postdepositional period of exactly 58 days was recorded for a natural nest of 5 eggs. Growth is most rapid during the summer of hatching, and sexual maturity is attained within the first year of life usually shortly before or during the first spring. Autotomy of the tail is considered a faculty of survival value. About 17 per cent of a sample of 808 lizards had broken the tail under natural conditions. Comparison of lizards with complete and broken tails indicates that the frequency of breakage is greater during the juvenile and young adult stage. The greater the portion of the tail lost the greater the regeneration, but regenerated tails do not reach the maximum length attained by unbroken ones. A description of molting is presented. The first molt occurs at an average of about 33 days after hatching as determined in a series of 18 individuals which had an average snout-vent length of 33 mm. during the initial molt. The average interval between the first and second molts for 7 young was 29 days and their average snout-vent length during the second molt was 38 mm. Five or 6 molts per year is apparently normal. Food habits were studied by stomach analysis and field observation. Terrestrial arthropods constitute the diet of this lizard with an occasional vertebrate, Lygosoma laterale, being eater. Possible predators and escape mechanisms are discussed. Natural and accidental injuries sustained by fence lizards were recorded and the degree of recovery was noted. Density of the breeding population in 1956 was 19.8 lizards per acre as compared to 20.4 lizards per acre for the breeding population in 1957, which indicates great stability of population level in 2 years. The population reaches its greatest density in August or September and at this time of the year the population is largely composed of the season's young. Survival rates of the fence lizard during the summer of hatching are low and the majority of the young of a given season do not attain one year of age. The average ecological life expectancy of 192 young hatched during the summer of 1956 and captured at least twice was about 3 months; about 6 per cent were known to attain one year of age. In March, 1957 only 11 adults of an original group of 48 adults recorded in March, 1956 were present. It may be assumed that about 77 per cent annual mortality had occurred because none of these lizards were ever recorded outside the study area. The maximum age estimated for any lizard was 28 months.

Microfilm $2.00; Xerox $6.80. 141 pages.

A STUDY OF MICROSPORIDIOSIS IN THE EUROPEAN CORN BORER, PYRAUSTA NUBILALIS (HÜBNER)

(L. C. Card No. Mic 58-5443)

John Paul Kramer, Ph.D.
University of Illinois, 1958

Perezia pyraustae Paillot (Protozoa, Sporozoa, Nosematidae) which is the causative agent of microsporidiosis in Pyrausta nubilalis (Hbn.), assumes a variety of forms in the course of its development. These include: sporoplasms, sporonts, sporoblasts, and spores. Descriptions of the aforementioned forms and their intermediates are given and compared with earlier accounts of this protozoan. A life cycle incorporating hitherto underscribed forms of the parasite is suggested. It involves not only direct development from spore to spore, but also a vegetative cycle in which schizonts produce more schizonts. The life cycle of the parasite is completed in about three days.

Hereditary transmission of the parasite involves internal and external contamination of certain eggs laid by infected adult females. Internal contamination may include one or more of the following: sporoplasms, schizonts, and spores. External contamination consists of spores which are lodged in the foveae of the egg shell. With the exception of internal contamination in the form of spores, none of the above information pertaining to microsporidiosis in P. nubilalis has been previously reported. Considering external as well as internal contamination, it appears that infected adult females transmit the pathogen to no less than one-half of their offspring.

Perezia infections were found in the malpighian tubes and silk glands of larval hosts, malpighian tubes of adult hosts, and genital tracts of adult females. Spore forms of the parasite were found in a variety of other structures within larval and imaginal hosts. The occurrence of spores in these structures probably represents random dispersions of spores sloughed from the sites of infection given above.

A marked difference in rate of survival was observed between congenitally infected versus disease-free P. nubilalis. Among the former about 14% reached adulthood, while among the latter 75% reached maturity.

Statistical analyses of observed differences between uninfected and infected adult P. nubilalis revealed that infected adults have significantly shorter post-pupal life spans. In addition, infected adult females more often lay no eggs. Infected adult females which do produce one or more egg masses are significantly less productive than their uninfected counterparts. Such reductions in egg-mass

production among diseased adult females cannot be ascribed to reduced adult life expectancy. Infections within the reproductive tracts of such females are responsible for these reductions.

Examinations of more than 1700 living and dead larvae collected in the field over a four-year period indicate that P. pyraustae is now widely distributed within populations of P. nubilalis in Illinois. Observed seasonal fluctuations in the incidence of the parasite was taken as evidence that infected individuals are more susceptible to the seasonal stresses of temperature. Greater susceptibility to high temperatures among infected individuals was demonstrated in the laboratory.

That P. pyraustae is an effective suppressor of populations of P. nubilalis is revealed by an inspection of the aforementioned laboratory and field data. However, chronically infected individuals do exist in any population. Such individuals are reservoirs which perpetuate microsporidiosis in nature. Microfilm $2.00; Xerox $4.00. 74 pages.

BIONOMICS OF THE BROWN WOODS MOSQUITO, AEDES STIMULANS (WALKER) (DIPTERA, CULICIDAE)

(L. C. Card No. Mic 58-5453)

Ivan Noel McDaniel, Ph.D.
University of Illinois, 1958

A new and unique method for bringing about mating of floodwater mosquitoes in the laboratory has been devised. Decapitated males were found to copulate readily with females when they were presented in the proper mating position. This technique provides a method for obtaining fertile eggs in the laboratory from many species of floodwater mosquitoes which do not mate under laboratory conditions.

The horizontal distribution of eggs of Aedes stimulans was investigated in a natural developmental site. The distribution of eggs varied according to the fluctuating water table, and at times eggs occurred over much of the area. However, the majority of eggs were always distributed as a band located near the high-water mark. The level of water within the site influenced the level at which oviposition occurred. Females usually placed their eggs on moist soil at a horizon approximately seven inches (vertical distance) above the level of water within the pool.

Eggs of Aedes stimulans were distributed vertically in the soil to depths down to 40 mm. below the surface. Eggs of associated species were recovered likewise at various depths. Eggs of Aedes vexans were distributed to depths even exceeding 75 mm. When samples of soil were examined at the time of oviposition, newly oviposited eggs were distributed to a maximum depth of only 10 mm. It would appear that the tunnelling action of soil organisms is largely responsible for the movement of eggs to depths exceeding 10 mm.

Living nematode larvae were found within eggs produced by laboratory-reared adults of Aedes stimulans. Apparently this is the first recorded occurrence of an organism passing from the adult mosquito to its egg.

A microsporidian parasite frequently infested reared larvae of Aedes stimulans. Larvae sufficiently infested to show symptoms always died before pupation. Possibly asymptomatic larvae carried the inoculum to the next generation.

Aedes stimulans produces but a single generation each year under field conditions. Eggs in natural situations are subjected to extended exposures to low temperatures before they hatch. Similarly, eggs kept in the laboratory hatched only after extended exposure to temperatures near the freezing point of water.

Methods for stimulating hatching were investigated in order to determine their effect on eggs of this species. Those methods which brought about a slow decline in the quantity of dissolved oxygen in the medium under which the eggs were submerged, produced the higher rates of hatching. Media which support growth of bacteria were found to be very effective.

A highly successful technique was devised for rearing larvae of Aedes stimulans in the laboratory. The techniques employed should be adaptable for the successful rearing of related species.

Larval development was observed under field conditions. The larvae developed more rapidly when hatching occurred late in the season. Likewise, when hatching took place early, the period of larval development was extended.

Larvae of Aedes stimulans were reared in the laboratory at various temperatures. Rearing was most successful at a temperature of 20° C. Records including feeding, oviposition, and longevity are given for both field and laboratory-reared adults.

Microfilm $2.00; Xerox $5.80. 117 pages.

A TAXONOMIC STUDY OF THE POCKET GOPHERS, GENUS GEOMYS, OF THE CENTRAL UNITED STATES

(L. C. Card No. Mic 58-5454)

Charles Albert McLaughlin, Ph.D.
University of Illinois, 1958

In order to obtain a better understanding of the geographic distribution and the evolutionary relationships between the various races of the pocket gophers of the genus Geomys of the central United States, a careful analysis of the variation within populations was first made, with particular attention being given to age and secondary sexual variations as manifested in the external features and skulls. Some 3460 specimens of Geomys bursarius, G. arenarius, and G. personatus were examined from the known geographic ranges of these species -- extreme southern Manitoba, Canada to southern Tamaulipas, Mexico, east base of the Rocky Mountains to western Indiana and Wisconsin. Nineteen geographic races of Geomys bursarius, seven races of G. personatus, and two races of G. arenarius are recognized within the range and critical comments are included on the morphological and ecological variations within the species. The nineteen races of bursarius fall into three groups on the basis of morphology and geography, a large dark-colored bursarius group, a large light-colored lutescens group, and a small dark-colored breviceps group. The breviceps group may represent an incipient species. G. b. levisagittalis, G. b. hylaeus, and G. b. vinaceus are considered to be local variations of G. b. lutescens. The former range of G. b.

bursarius west of the Mississippi river is shown to actually support a population of G. b. majusculus. G. b. bursarius, G. b. illinoensis, and G. b. missouriensis originated independently from a majusculus-like ancestor. G. b. illinoensis was separated from the parent population by the Illinoian Glaciation which destroyed those pocket gophers in the area between the Illinois and Mississippi rivers. The seven races of G. personatus fall into two groups, a larger coastal group, and a smaller group found along the Nueces River and further inland. All living Geomys appear to have originated with a lutescens-like form whose range included the western great plains area. During the Pleistocene the range of the southeastern U. S. pocket gophers was separated from the range of G. bursarius.

Microfilm $3.85; Xerox $13.00. 298 pages.

FACTORS AFFECTING GENE EXCHANGE BETWEEN TWO ALLOPATRIC POPULATIONS IN THE BUFO WOODHOUSEI COMPLEX

(L. C. Card No. Mic 58-3988)

William Ross Meacham, Ph.D.
The University of Texas, 1958

Supervisor: Dr. W. Frank Blair

There has been a marked lack of specific information regarding the distributional, taxonomic, and genetic relationships of the toads, Bufo woodhousei and Bufo fowleri, along the line of contact of their ranges in the central United States. In an effort to elucidate these relationships, field and laboratory studies of eastern and central Texas populations were conducted over a four-year period. A total of 932 adults were collected in the field and forty-one laboratory crosses and backcrosses were made involving the parental forms and their laboratory hybrids in all possible combinations.

Special attention was given in the field to an evaluation of the commonly observed anuran isolating mechanisms as they affected woodhousei and fowleri along the contact zone. Evidence was presented indicating that ecological isolation is the principal factor acting to maintain the integrity of the two forms in Texas. Even this was found to be relatively ineffective in those areas of mixed or interdigitated habitat resulting from man's disruption of the normal ecological balance. The vegetational, climatic, and edaphic properties of three major zones within the study area were discussed in their relationship to the ecology of woodhousei and fowleri.

The morphological relationships of the parental forms to each other and to the intergrade progeny were investigated through statistical treatment of six body measurements. These showed the intergrades to be generally intermediate between the parental taxa. A correlation was found to exist in the morphological nature of an intergrade sample and its geographical position within the intergrade zone.

It was concluded that woodhousei and fowleri are intergrading freely over a narrow but extended north-south zone in Texas and probably should be regarded as subspecies. It was further concluded that the present contact is a secondary one and is explainable on the basis of fragmentation of a formerly homogeneous population during the Pleistocene. Microfilm $2.00; Xerox $6.60. 139 pages.

A STUDY OF THE RELATIONSHIP BETWEEN THE PRONEPHROS AND THE HAPLOID SYNDROME IN FROG LARVAE

(L. C. Card No. Mic 58-5479)

Nancy Schwarz Rafferty, Ph.D.
University of Illinois, 1958

A study of the cause of haploid edema (which may result from pronephros dysfunction) was undertaken by menas of transplanting one or two pronephric primorida reciprocally between diploid and haploid embryos of Rana pipiens. Appropriate operational controls were made. Diploid larvae supporting a haploid pronephros in addition to an intact diploid kidney developed normally; the presence of the haploid pronephros was indicated only by an increase in early deaths, which also characterized all haploid larvae used in these experiments. Diploid larvae supporting only haploid pronephros displayed an edematous retarded development, limited survival, and early and late peaks of death characteristic of haploid larvae. That the harmful effect on the diploid larvae by the haploid pronephros was not due to a general toxic reaction was shown by the normal development and survival of diploid larvae receiving transplants of haploid tail tissue. That the poor development of these diploid larvae is due to only a partial functioning of the haploid kidney is suggested.

The syndrome of abnormalities of haploid larvae was not modified by the presence of one or two diploid pronephroi or of diploid tail tissue. All died within the time usual for haploids following an edematous, retarded development. The early death peak, however, was eliminated in haploid larvae supporting one diploid pronephros along with an intact haploid kidney; the late death peak persisted. It is suggested that other factors besides kidney dysfunction are involved in the inviability of haploid frog larvae.

Concerning the fate of haploid transplants in diploid hosts, it was found that only 4 of 12 had remained haploid while 8 contained either a few or a predominance of diploid cells. The older transplants contained a larger number of diploid cells than the younger transplants. Of 10 similar transplantations of haploid anlagen into haploid hosts, all transplants remained haploid. It is not known whether the haploid cells were themselves regulating to the diploid number under some influence of the diploid host, or whether the haploid cells of the transplant were being replaced by diploid host cells.

Microfilm $2.00; Xerox $3.00. 41 pages.

EXPERIMENTALLY INDUCED CHANGES IN LAKES. a) ENVIRONMENTAL CHANGES FOLLOWING LIME-APPLICATION TO STAINED LAKES. b) CHANGES IN THE PLANKTONIC CRUSTACEA FOLLOWING THE INTRODUCTION OF TROUT TO A FISH-FREE LAKE.

(L. C. Card No. Mic 58-2577)

Raymond George Stross, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Arthur D. Hasler

Small bog lakes appear to offer comparatively simple and stable ecosystems for the study of environmental alterations. The object of one study was to ascertain certain effects from adding hydrated lime to one portion of an artifically divided hourglass-shaped lake. The other part served as a control from which alterations of certain physical, chemical, and biological conditions in the treated portion were evaluated. In the second study the planktonic Crustacea, particularly the Daphnia population, served as a bioassay for determining the effect of substituting trout for insects as predators.

Following the addition of hydrated lime nearly 100 percent solubility was achieved through adequate dispersal of the particles of lime, for which a method is described, and by limiting the application to slightly more than can be transformed immediately to bicarbonate.

Lime-treatment increased the depth to which light penetrated in the treated portion reaching a maximum of 100 percent after three years. In two other lakes treatment produced increases of 25 to 40 percent within three weeks.

In comparatively small lakes the clarity of the water is of decisive importance in determining the thickness of the epilimnion. This was demonstrated in the experimental lake and in 11 others in northeastern Wisconsin and Upper Michigan; the lakes vary in size from 0.3 to 75 acres, and in transparency, from 1.0 to 18.0 meters. With two exceptions the thickness of the epilimnion is 0.5 to 0.6 the value of transparency. A doubling of this layer in the treated portion, over that of the control, resulted in a 21 to 23 percent increase in the annual heat budget.

Calcium, magnesium, and bicarbonate were measured to determine the efficiency of each application of lime. Although a calculated 70 percent of the iron was removed from the lime-treated portion, the iron which remained was effective in removing phosphorus from the trophogenic layer. The small supplementary additions of lime were insufficient to increase the level of phosphorus in the lake.

The average annual standing crops of planktonic crustacea were much more consistent in the control that those in the treated portion. A part of the variability was attributed to the discontinuation of lime-treatment. Among the changes in species-composition Daphnia longispina replaced Daphnia pulex in the treated portion; D. longispina continued to be predominant in the treated portion, while D. pulex dominated the control.

The growth-form of the two populations of Daphnia was described for a 96-day period from daily changes in three embryonic and three postnatal size-age categories. Calculations of mortality in the population for the 96 days were based on the concomitant changes in these categories during each computed interval corresponding to the sojourn of embryos in the brood pouch. Values of mortality were then used to calculate turnover-times for the two populations; they were 2.1 weeks for D. longispina and 5.7 weeks for D. pulex.

The percentage of embryos in the Daphnia populations was suggested to be proportional to the rate of turnover. It was shown that the reproductive intensity of Daphnia, as measured by the percentage of embryos, was inversely related to the average standing population of Daphnia for each of the three years. However in another untreated bog lake in which other species of Crustacea were predominant the reproductive intensity was inversely proportional only to the entire standing population of planktonic Crustacea.

Part II showed the vertical redistribution of a population of D. pulex in a naturally occurring fish-free lake when small rainbow trout were substituted for insects which preyed upon the planktonic Crustacea. Prior to treatment, nymphal notonectids and larval dytiscids occupied the upper 2-meter stratum, and the Daphnia were distributed below this region. After the trout eliminated the insects from this zone, the Daphnia assumed a normal vertical distribution, the average seasonal abundance doubled, but the average dry weight of the planktonic Crustacea indicated that no change in standing crop occurred as a result of the substitution of predators.

Microfilm $2.20; Xerox $7.80. 167 pages.

A TAXONOMIC REVISION OF THE SPOTTED SKUNKS (GENUS SPILOGALE)

(L.C. Card No. Mic 58-5510)

Richard George Van Gelder, Ph.D.
University of Illinois, 1958

The spotted skunks (genus Spilogale), which were last revised in 1906, are restudied on the basis of 1,974 museum specimens. Analyses of the distribution, the age, sex, color pattern, and individual variation, the probable prehistory, and the evolutionary trends of spotted skunks are presented. The taxa of the genus are arranged in two species, Spilogale putorius, a large-sized, polytypic species of wide distribution with 15 subspecies, and Spilogale pygmaea, a small-sized, monotypic species, with a restricted range. The differences between the two species and between the subspecies of Spilogale putorius are mainly those of size and color pattern.

Microfilm $5.25; Xerox $18.80. 411 pages.

AUTHOR INDEX

AARON, Ida S. TEACHERS' ATTITUDES TOWARD CHILDREN'S BEHAVIOR: A STUDY OF TEACHERS' ATTITUDES TOWARDS CHILDREN'S BEHAVIOR PROBLEMS AND THEIR RELATIONSHIP TO PUPIL-TEACHER MORALE. XIX, 1024

ABRAHAMSON, George Raymond. PERMANENT PERIODIC SURFACE DEFORMATIONS DUE TO A TRAVELLING JET. XIX, 1047

ALBRECHT, James Joseph. CHARACTERISTICS OF CORN STARCH AND STARCH DERIVATIVES AS AFFECTED BY FREEZING, STORAGE, AND THAWING. XIX, 1049

AMOS, Dewey Harold. GEOLOGY AND PETROLOGY OF THE CALAIS AND ROBBINSTON QUADRANGLES, MAINE. XIX, 1052

ANDERSON, Jack Roger. THE DETERMINATION OF THE WETTING CHARACTERISTICS OF STARCHES AND OTHER POLYMERS AS MEASURED BY CONTACT ANGLES. XIX, 965

ANDRUS, Jan Frederick. PARTIALLY ORDERED IDEAL PRESERVING GROUPS. XIX, 1083

APPLING, William David Love. CONCERNING INTEGRALS. XIX, 1083

ARONSON, Arthur Ian. THE ROLE OF PROTEIN IN THE SYNTHESIS OF NUCLEIC ACID. XIX, 942

ATAL, Chand Kumar. A PHARMACOGNOSTIC STUDY OF WITHANIA SOMNIFERA DUNAL. XIX, 1059

ATCHISON, Calvin O. A COMPARATIVE STUDY OF THE SELF-CONCEPT OF BEHAVIOR PROBLEM AND NON-BEHAVIOR PROBLEM HIGH SCHOOL BOYS. XIX, 1010

ATKYNS, Glenn Chadwick. TEACHING FOR INTERNATIONAL UNDERSTANDING: BASIC STRUCTURE OF A SECONDARY SCHOOL COURSE UTILIZING THE FINDINGS OF SOCIAL PSYCHOLOGY AND CULTURAL ANTHROPOLOGY. XIX, 1025

AUGUST, Stephen. COMPARISON OF CONNECTICUT SUPERINTENDENTS' BELIEFS CONCERNING JOB EXPECTATIONS OF EXPERIENCED TEACHERS WITH REPORTED EXPECTATIONS OF THE SAME TEACHERS. XIX, 996

AYE, Tin. X-RAY STUDY OF BIOTITE FROM THE SCOTT MINE, STERLING LAKE, NEW YORK. XIX, 1053

BABILOT, George. AN ANALYSIS OF DIRECT AND INDIRECT TAXATION: A RE-ORDERING OF SOME BASIC CONCEPTS IN TAX THEORY. XIX, 980

BAILEY, Anne V. A SUGGESTED PROGRAM FOR A THREE-YEAR COURSE IN SPEECH FOR A SENIOR HIGH SCHOOL: A STUDY TO DISCOVER THE SPEECH NEEDS OF A SELECTED HIGH SCHOOL AND SUGGESTIONS FOR SOLVING THE PROBLEMS INVOLVED. XIX, 1137

BAIRD, Quincey Lamar. AN IRON FREE DOUBLE-FOCUSING SPECTROMETER AND THE SPECTRUM ANALYSIS OF GOLD-199 ABOVE 15 KEV. XIX, 1098

BARR, Doris Wilson. A MODEL AND METHOD FOR CONTENT ANALYSIS; IMPLEMENTATION IN A STUDY OF MAGAZINE COVERS. XIX, 1070

BARRY, JR., John Joseph. THE EFFECT OF STIMULATION OF THE FORNIX AND CAUDATE ON THE BEHAVIOR OF THE CAT. XIX, 1122

BEAR, Willard B. AN APPRAISAL OF SECONDARY SCHOOL CURRICULUM MATERIALS PUBLISHED BY THE OREGON STATE DEPARTMENT OF EDUCATION. XIX, 984

BEATTY, George Franklin. LAND, WATER, AND AGRICULTURE IN VILLAGE COMMUNITIES OF THE UPPER DAMODAR VALLEY, INDIA. XIX, 1051

BELSER, JR., Thomas Arvin. MILITARY OPERATIONS IN MISSOURI AND ARKANSAS, 1861-1865. XIX, 1064

BERRYMAN, Robert Glen. LEGAL LIABILITY IN PUBLIC ACCOUNTING PRACTICE. XIX, 976

BICKLEY, Carl Edward. AN ANALYSIS OF SELECTED FACTORS WHICH AID OR DETER SCHOOL DISTRICT REORGANIZATION IN CERTAIN INDIANA COUNTIES. XIX, 997

BINNIE, Robert Rexford. FACTORS INFLUENCING THE AVAILABILITY OF POTASSIUM IN ALLUVIAL AND ASSOCIATED NON-ALLUVIAL SOILS OF INDIANA. XIX, 924

BLANKFIELD, Judith Richman. APPROXIMATIONS TO EINSTEIN'S EQUATIONS OF GENERAL RELATIVITY. XIX, 1083

BLASE, Ernest Frederich. THE RADIATION CHEMISTRY OF SOME LOW MOLECULAR WEIGHT ORGANIC SOLVENTS. XIX, 965

BLISSITT, Charles William. A COMPARISON OF THE ANTIBACTERIAL ACTIVITY OF ERYTHROMYCIN IN VARIOUS SUPPOSITORY BASES. XIX, 1059

BOHN, Louis Albert. DESIRABLE AND UNDESIRABLE BUILDING FEATURES AND SPACES IN SELECTED TEXAS ELEMENTARY SCHOOLS. XIX, 997

BOLTON, Dale Leroy. GRANTS-IN-AID AND EQUALIZATION OF EDUCATIONAL OPPORTUNITY IN WISCONSIN. XIX, 998

BORDIE, John George. A DESCRIPTIVE SINDHI PHONOLOGY. XIX, 1075

BOSDELL, Betty Jane. PERCEPTIONS OF GUIDANCE SERVICES AS RELATED TO PERSONALITY NEEDS AND JOB TITLE. XIX, 1010

BOSTWICK, David Arthur. STRATIGRAPHY OF THE GAPTANK FORMATION, GLASS MOUNTAINS, TEXAS. XIX, 1053

BOVA, JR., Louis William. PERCEPTUAL RIGIDITY: AN EXPERIMENT WITH THE RORSCHACH TEST AND THE AUTOKINETIC EFFECT. XIX, 1112

BOWLAND, John Anthony. THE EFFECTS OF VARYING INTENSITY ON THE AUDITORY TIME-ERROR. XIX, 1123

BOWLBY, Roger Louis. THE STATUTORY REGULATION OF MINIMUM WAGES IN GREAT BRITAIN. XIX, 973

BOWLIN, Ruth Elizabeth. THE CHRISTIAN PROPHETS IN THE NEW TESTAMENT. XIX, 1129

BOXER, Arnold Sander. THE THERMAL CONDUCTIVITY OF IMPURE TIN AT LOW TEMPERATURES. XIX, 1092

BRANTLEY, Blake Bridges. EFFECT OF NUTRITION AND OTHER FACTORS ON FLOWERING, FRUITING, AND QUALITY OF WATERMELONS AND MUSKMELONS. XIX, 925

BRAUN, Robert A. THE REACTION OF HYDRAZINE WITH 2-ACYL-1, 3-INDANDIONES AND RELATED TOPICS. XIX, 953

BRIGGS, Norman Theodore. SEROLOGICAL RESPONSES OF COTTON RATS AND WHITE RATS IN RELATION TO THE EXTENT OF INFECTION WITH LITOMOSOIDES CARINII (TRAVASSOS, 1919) CHANDLER, 1931. XIX, 1062

BROCK, William Elihu. A STUDY OF THE PATHOGENESIS OF THE ANEMIA IN ACUTE ANAPLASMOSIS. XIX, 1058

BROPHY, John Allen. MINERALOGY OF SANGAMON WEATHERING PROFILES. XIX, 1054

BROWN, Louis. ANNIHILATION OF POSITRONS IN ALKALI HALIDE CRYSTALS. XIX, 1092

BROWNSTEIN, Jewell Brown. A STUDY OF CHILDREN WITH CONTRASTING RECORDS OF SOCIAL ADJUSTMENT IN RELATION TO CERTAIN SCHOOL, HOME AND COMMUNITY FACTORS. XIX, 1011

BRUCH, Carl William. THE RESPONSE OF VARIOUS BACTERIA TO DRYING IN AN AIR STREAM. XIX, 933

BRYANT, Richard Miles. THE RELATIONSHIP OF ANXIETY TO THE ASSOCIATIVE AND NONASSOCIATIVE ASPECTS OF SIMPLE AND COMPLEX LEARNING. XIX, 1112

BURKE, James Murray. THE DEVELOPMENT OF A TEST OF CRITICAL THINKING FOR PUPILS IN GRADES FIVE AND SIX. XIX, 1025

BUSHNELL, Clyde Gilbert. THE MILITARY AND POLITICAL CAREER OF JUAN ALVAREZ, 1790-1867. XIX, 1065

BUTLER, Donald E. DERIVATIVES OF PIPERAZINE. XIX. THIOETHER DERIVATIVES OF PIPERAZINE AND SUBSTITUTED PIPERAZINES. XIX, 953

BYRNE, Donn Erwin. RESPONSE TO HUMOR AS A FUNCTION OF DRIVE AROUSAL AND PSYCHOLOGICAL DEFENSES. XIX, 1113

CABBLE, JR., George Merrifield. ADHESION BETWEEN RAILS AND WHEELS OF RAILWAY MOTIVE POWER. XIX, 1045

CAHILL, Robert Joseph. STEFAN ANDRES AND "DIE ORDNUNG DER WELT." XIX, 1076

CAMERON, Robert M. POLICIES AND PRACTICES OF DEPARTMENT STORES AS RELATED TO EXECUTIVE TRAINEES. XIX, 1026

CAMPBELL, JR., Bruce N. CERTAIN ASPECTS OF THE FRIEDEL-CRAFTS REACTION. XIX, 953

CAMPBELL, James Wayne. THE NITROGEN AND AMINO ACID COMPOSITION OF THREE SPECIES OF ANOPLOCEPHALID CESTODES: MONIEZIA EXPANSA, THYSANOSOMA ACTINIOIDES, AND CITTOTAENIA PERPLEXA. XIX, 942

CARR, Thomas Deaderick. STUDIES OF RADIO FREQUENCY RADIATIONS FROM THE PLANETS. XIX, 933

CAREW, David P. THE PRODUCTION AND GROWTH OF RYE EMBRYO CALLUS. XIX, 1060

CARRUTH, Bruce Chandler. AN EXPLORATORY STUDY OF PHENOMENOLOGICAL INTERPERSONAL RELATIONS. XIX, 1133

CARTER, Cleo Dorris. THE RELATIONSHIP BETWEEN PERSONALITY AND ACADEMIC ACHIEVEMENT (READING AND ARITHMETIC) OF SEVEN YEAR-OLDS. XIX, 1027

CASSELL, John Thomas. A STUDY TO DEVELOP A GUIDE FOR USE IN ESTABLISHING OR EVALUATING SPECIAL PROGRAMS FOR THE MENTALLY HANDICAPPED. XIX, 999

CHILDERS, William Cole. THE DICTION OF THE POETRY OF BYRON. XIX, 1077

CHU, Ming-Yu Wang. NUTRITIONAL STUDIES ON AZOTOBACTER AND ITS MUTANT. XIX, 934

CHUTIKUL, Kavi. STUDIES ON EFFECTS OF HIGH ENVIRONMENTAL TEMPERATURE ON THE GROWING CHICKEN. XIX, 921

CLARK, Kenneth Wyllie. THE ADAPTATION OF AN ARTIFICIAL RUMEN TECHNIQUE TO THE ESTIMATION OF THE GROSS DIGESTIBLE ENERGY OF FORAGES. XIX, 926

CLARK, William Dempsey. A MASS SPECTROMETRIC STUDY OF THE THERMAL DECOMPOSITION OF AZOETHANE AT LOW PRESSURES. XIX, 966

AUTHOR INDEX

CLAROS, Thomas Stavros. THE CURRICULUM OF THE GREEK GYMNASIUM. XIX, 999

COHEN, Burton Herbert. AN EVALUATION OF THREE ASSOCIATIONAL RATIONALES OF VERBAL GENERALIZATION. XIX, 1123

COLEMAN, Harold James. PROBLEM-SOLVING FLEXIBILITY AS A FUNCTION OF SYSTEMATICALLY CONTROLLED EXPERIENCE. XIX, 1124

COLLIER, Richard Edward. FACTORS RELATED TO CHILDREN'S EXPRESSED COLOR PREFERENCES AT SELECTED GRADE LEVELS. XIX, 985

CONCEPCION, Gregorio Hernandez. STRENGTH OF PRESTRESSED CONCRETE BEAMS WITH WEB REINFORCEMENT. XIX, 1036

COPELIN, Edward Casimere. THE ATTEMPTED SYNTHESIS OF 2, 2'-BIPYRIMIDINE and ATTEMPTS TO ESTABLISH PERFORMANCE TESTS FOR INFRARED SPECTROPHOTOMETERS. XIX, 950

CORLIS, Leming Bassett. A STUDY OF PLACE VS. RESPONSE BEHAVIOR, LEARNING AND REASONING IN THE WHITE RAT. XIX, 1124

COROTTO, Loren Vincent. AN EVALUATION OF SELECTED ASPECTS OF THE MATHEMATICS PROGRAM AT THE UNIVERSITY OF HOUSTON. XIX, 1084

CROSS, Kathryn Patricia. A FIELD STUDY OF INDIVIDUAL CONFORMITY TO GROUP OPINION. XIX, 1133

DANLY, Donald Ernest. THEORETICAL AND EXPERIMENTAL STUDIES IN BATCH RECTIFICATION. XIX, 1032

DEAN, David William. PROJECTIONS IN CERTAIN CONTINUOUS FUNCTION SPACES. XIX, 1085

DHARIWAL, Anand Pal Singh. DETERMINATION AND DISTRIBUTION OF FIXED AMMONIUM IN SOILS. XIX, 926

DILLMAN, Lowell Thomas. SCINTILLATION STUDIES OF SOME NEUTRON DEFICIENT ISOTOPES OF LUTECIUM. XIX, 1098

DILLON, Richard Thomas. INVARIANT MAPPINGS BETWEEN PARTIALLY ORDERED VECTOR SPACES. XIX, 1086

DODGE, Donald W. TURBULENT FLOW OF NON-NEWTONIAN FLUIDS IN SMOOTH ROUND TUBES. XIX, 1032

DODGE, Stewart Charles. THE USE OF EVOLUTIONARY THEORY BY AMERICAN POETS: 1900-1950. XIX, 1077

DOEMLING, Donald Bernard. LYMPH FLOW STUDIES IN UNANESTHETIZED DOGS WITH EXTERNAL THORACIC DUCT-VENOUS SHUNTS. XIX, 1102

DOLLAHON, James C. GENETIC, ANATOMICAL AND PHYSIOLOGICAL ASPECTS OF DWARFISM IN CATTLE. XIX, 922

DOYLE, Frank Larry. THE GEOLOGY OF THE FREEPORT QUADRANGLE, ILLINOIS. XIX, 1054

DREYER, Donald Allen. SUSPENDED SOLIDS AS A LIMITING FACTOR IN THE DISINFECTION OF PRIMARY SEWAGE SLUDGE WITH CHLORINE. XIX, 1062

DRISCOLL, Willis Carpenter. A STUDY OF JUDGMENT OF TIME INTERVALS IN MIXED-RACIAL GROUPS. XIX, 1107

DUBECK, Michael. A QUANTITATIVE STUDY ON THE MERCURATION OF AROMATICS. XIX, 954

DUGAN, Ruth Roberta. A STUDY TO DETERMINE THE RELATIVE IMPORTANCE OF SELECTED PERSONAL FACTORS IN THE EFFECTIVE TEACHER. XIX, 1020

DUNCAN, James Wilbur. THE EFFICIENCY OF EXCITATION OF A SURFACE WAVE ON A DIELECTRIC CYLINDER. XIX, 1039

EBCIOGLU, Ibrahim Kutsi. THEORETICAL ANALYSIS OF ELASTIC AND PLASTIC BUCKLING OF POLYGON-SHAPED PLATES UNDER VARIOUS EDGE LOADINGS AND SIMPLY SUPPORTED BOUNDARY CONDITIONS. XIX, 1031

EBY, Robert Newcomer. CHARACTERISTICS OF SPIRAL FLOW. XIX, 1033

EDMUND, Neal R. A STUDY OF THE RELATIONSHIP BETWEEN PRIOR EXPERIENCES AND THE QUALITY OF CREATIVE WRITING BY SEVENTH GRADE PUPILS: XIX, 1021

EICHHORN, John Harris. ASPECTS OF ADRENAL CORTICOSTEROIDOGENESIS, WITH SPECIAL REFERENCE TO CERTAIN INTERMEDIARIES AND TO FACTORS INFLUENCING CORTICOID FORMATION IN VITRO. XIX, 1102

ENDLER, Norman Solomon. CONFORMITY ANALYZED AND RELATED TO PERSONALITY. XIX, 1114

ENGELBRECHT, Gladys M. SCHOLASTIC SUCCESS OF STUDENTS CHANGING SCHOOL OR COLLEGE WITHIN THE UNIVERSITY OF CONNECTICUT. XIX, 986

ERICKSON, Ernst Walfred. COLLEGE AND UNIVERSITY LIBRARY SURVEYS, 1938-1952. XIX, 1081

ESTERSON, Jack Isaac. A STUDY OF EFFECTS OF BALANCE UPON THE PERCEPTION OF SOCIAL SITUATIONS. XIX, 1107

ESTES, Dwain McKinley. THE ELEMENTARY SCHOOL PRINCIPAL AT WORK WITHIN THE LOCAL ORGANIZATIONAL FRAMEWORK FOR ADMINISTRATION AND SUPERVISION. XIX, 1000

FARLEY, Nancy Bess. THE TEMPORAL ORIENTATION OF THE FEMALE JUVENILE DELINQUENT. XIX, 1012

FAULKNER, JR., Russell Conklin. THE EFFECT OF P-32 IRRADIATION ON THE ECTODERMAL AND MESODERMAL COMPONENTS OF THE DOWN FEATHER IN THE CHICK. XIX, 1141

FAY, JR., Thomas Holland. AN EXPERIMENTAL STUDY OF THE INTELLIGIBILITY OF ALPHABET LETTERS. XIX, 1137

FELTON, Frances G. HEMAGGLUTINATION WITH HERPES SIMPLEX VIRUS. XIX, 935

FIORICA, Vincent. EFFECT OF DIETS HIGH IN MEAT PROTEIN ON NITROGEN METABOLISM IN THE ADULT MALE. XIX, 1103

FITZGERALD, John Henry. FACTORS INFLUENCING CRAFTS PRACTICES IN JUNIOR HIGH SCHOOL ART AND INDUSTRIAL ARTS PROGRAMS. XIX, 987

FITZHUGH, Kathleen B. YIELDING BEHAVIOR OF DELINQUENT AND NON-DELINQUENT ADOLESCENTS. XIX, 1108

FITZHUGH, Loren Charles. THE PERCEPTUAL, ABSTRACTING AND PLANNING PERFORMANCES OF SELECTED ADOLESCENT GROUPS. XIX, 1114

FITZPATRICK, JR., Ben. OPERATOR MATRICES AND SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS. XIX, 1086

FOOTE, Warren Christopher. REPRODUCTION IN THE YEARLING EWE AS AFFECTED BY BREED AND SEQUENCE OF FEEDING LEVELS. XIX, 1104

FORD, JR., John A. STERIC EFFECTS OF GEM-DIMETHYL SUBSTITUTION. XIX, 954

FORMICA, Louis Anthony. A COMPARATIVE STUDY OF SELECTED FACTORS IN THE VOCATIONAL DEVELOPMENT OF INTELLECTUALLY SUPERIOR COLLEGE GIRLS FROM THE WORKING AND UPPER-CLASS LEVELS. XIX, 1012

FRAZIER, JR., Charles Edward. THE DAWN OF NATIONALISM AND ITS CONSEQUENCES IN NICARAGUA. XIX, 1065

FRAZIER, Elizabeth. A STUDY OF CERTAIN AUTONOMIC PHYSIOLOGICAL REACTIONS OF SELECTED CHILDREN READING AT VARIOUS LEVELS OF DIFFICULTY. XIX, 1013

FREDERICK, William Crittenden. INTRODUCTION TO A CULTURAL THEORY OF MONEY. XIX, 982

FRENCH, Richard Aubrey. SIR WALTER SCOTT: AN AMATEUR. XIX, 1071

FUSSELL, Clyde Greenleaf. THE EMERGENCE OF PUBLIC EDUCATION AS A FUNCTION OF THE STATE IN VERMONT. XIX, 1001

GACEK, Edward John. PRIVATE JUNIOR COLLEGE LEGISLATION IN THE UNITED STATES. XIX, 1001

GALASYN, Valentine David. OBSERVATIONS ON THE RARE EARTHS: CHEMICAL AND ELECTROCHEMICAL STUDIES OF SOLUTIONS OF RARE EARTH METAL SALTS IN ANHYDROUS DIMETHYLFORMAMIDE. XIX, 950

GANTZ, Ralph Lee. A STUDY OF THE HERBICIDAL EFFECTIVENESS OF ALPHA-CHLORO-N, N-DIALLYLACETAMIDE WHEN INCORPORATED INTO THE SOIL. XIX, 926

GARDINER, Robb Golder. A STUDY OF SELECTED AREAS OF THE SYSTEM OF SOCIAL FRATERNITIES AT MICHIGAN STATE UNIVERSITY. XIX, 1028

GARRETT, William. CHARLES WENTWORTH DILKE AS A LITERARY CRITIC. XIX, 1078

GASKINS, Murray Hendricks. GIBBERELLINS AND THEIR EFFECTS ON YIELD AND QUALITY OF BEANS (PHASEOLUS VULGARIS) AND SOUTHERN PEAS (VIGNA SINENSIS). XIX, 927

GATTERDAM, Paul Esch. TOXICOLOGICAL STUDIES ON SUBSTITUTED-VINYL PHOSPHATE INSECTICIDES. XIX, 943

GESLER, Harriet Lillian. AN ANALYSIS OF THE RELATION BETWEEN PITCH DISCRIMINATION AND PHONIC SENSITIVITY IN FIRST GRADE CHILDREN. XIX, 988

GHERITY, JR., James Arthur. ALFRED MARSHALL AND ECONOMIC DEVELOPMENT. XIX, 983

GOBELI, Garth William. ALPHA-PARTICLE IRRADIATION OF GERMANIUM AT 4. 2^{o}K. XIX, 1092

GOLD, Harvey Joseph. DEGRADATION OF CHLOROPHYLL TO PHEOPHYTIN DURING STERILIZATION OF CANNED GREEN PEAS BY HEAT. XIX, 1050

GOSSETTE, Robert Leonard. RESPONSE STRENGTH AS A JOINT FUNCTION OF DEPRIVATION (h) AND PREFEEDING (A). XIX, 1115

GRAY, Gordon Miles. A STUDY OF THE MINIMUM-WEIGHT PROPORTIONS FOR A DOUBLE-CANTILEVER TRUSSED ROOF SYSTEM. XIX, 1037

GREEN, Wilma Jeanne. STUDY OF THE ARRANGEMENT AND BEHAVIOR OF THE RETICULAR FIBRILS OF THE SPLEEN IN THE LEUKEMIAS. XIX, 1058

GREER, Robert William. AN INCLUSIVE DETERMINATION OF HIDDEN PHENOMENA IN, AND STABILITY CRITERIA OF, SAMPLED-DATA SYSTEMS. XIX, 1039

GRIMM, Dieter Wilhelm. A COMPARISON OF THREE SELECTED MEDICO-ECONOMIC ENVIRONMENTS AND THEIR EFFECT ON PRICES PAID BY CONSUMERS FOR SELECTED PHARMACEUTICALS. XIX, 1060

AUTHOR INDEX

GROBMAN, Hulda Gross. THE PUBLIC SCHOOL PRINCIPAL'S OPERATIONAL BEHAVIOR, THEORY AND PRACTICE, AND RELATED SCHOOL AND COMMUNITY INTERACTIONS, BASED ON DATA FROM THE INVESTIGATIONS OF THE UNIVERSITY OF FLORIDA CPEA LEADERSHIP PROJECT. XIX, 1002

GURSKY, Martin Leon. NUCLEAR BINDING ENERGY FROM THE INDEPENDENT PARTICLE MODEL. XIX, 1098

HAAS, JR., John William. DERIVATIVE POLAROGRAPHY OF THE ALDOPENTOSES. XIX, 967

HACKETT, James Edward. GROUNDWATER GEOLOGY OF WINNEBAGO COUNTY, ILLINOIS. XIX, 1054

HAINES, Charles Edward. THE EFFECTS OF RESTRICTED ENERGY INTAKE ON REPRODUCTION IN GILTS. XIX, 919

HALE, Paul Byron. INTRODUCING AVIATION EDUCATION IN ILLINOIS SECONDARY SCHOOLS. XIX, 988

HALL, Louis Brewer. THE STORY OF DIDO AND AENEAS IN THE MIDDLE AGES. XIX, 1071

HALL, William Eaton. THE EFFECTS OF SET AND REINFORCEMENT IN VERBAL CONDITIONING. XIX, 1115

HALLMAN, Theodore Morgan. COMBINED FORCED AND FREE CONVECTION IN A VERTICAL TUBE. XIX, 1045

HAMBURGER, Martin. REALISM AND CONSISTENCY IN EARLY ADOLESCENT ASPIRATIONS AND EXPECTATIONS. XIX, 1013

HAMILTON, Charles Granville. MISSISSIPPI POLITICS IN THE PROGRESSIVE ERA, 1904-1920. XIX, 1066

HAMMER, Charles Howard. A VALIDATION STUDY OF THE ACTIVITY VECTOR ANALYSIS. XIX, 1108

HANSON, Harold Carsten. STUDIES OF THE PHYSIOLOGY OF WINTERING AND OF MOLTING CANADA GEESE (BRANTA CANADENSIS INTERIOR). XIX, 1141

HARDBECK, George William. UNION-MANAGEMENT HEALTH AND WELFARE PROGRAMS SINCE 1945. XIX, 973

HARDER, Virgil Eugene. A HISTORY OF DIRECT MAIL ADVERTISING. XIX, 976

HARMIC, Jay L. SOME ASPECTS OF THE DEVELOPMENT AND THE ECOLOGY OF THE PELAGIC PHASE OF THE GRAY SQUETEAGUE, CYNOSCION REGALIS (BLOCH AND SCHNEIDER) IN THE DELAWARE ESTUARY. XIX, 1142

HARR, Milton Edward. WARPING STRESSES AND DEFLECTIONS IN CONCRETE SLABS. XIX, 1037

HARRISON, Gordon Ray. ANGULAR DISTRIBUTION MEASUREMENTS OF THE $B^{10}(d, p)B^{11}$ REACTION AT LOW DEUTERON ENERGIES. XIX, 1099

HARTZELL, Gordon Ellsworth. PREPARATION AND AROMATIZATION OF POLY-1, 3-CYCLOHEXADIENE. XIX, 955

HARVEY, Philip Richard. AN ANALYSIS OF VARIOUS FACTORS RELATED TO MARKING PRACTICES IN UNDERGRADUATE COURSES. XIX, 1028

HAWK, Travis Leon. CONCEPT OF SELF AS A VARIABLE IN ADOLESCENT BEHAVIOR. XIX, 1014

HEALY, Edward Augustine. PART I: THE INTERACTION OF HEXACHLOROSMATE(IV) WITH BIS-(SALICYLAL) ETHYLENEDIIMINE. PART II: THE KINETICS OF THE ACID DISSOCIATION OF TRIS-(PYRIDINAL-n-PROPYLIMINE) IRON(II). XIX, 951

HEALY, Harold Elton. PROMISING LEADERSHIP TECHNIQUES USED BY PRINCIPALS OF CONNECTICUT SECONDARY SCHOOLS. XIX, 1003

HENDERSON, Gerald Mitchell. ALFRED RUSSEL WALLACE: HIS ROLE AND INFLUENCE IN NINETEENTH CENTURY EVOLUTIONARY THOUGHT. XIX, 930

HENNEY, Gerald Christian. AN EVALUATION OF HUMECTANTS IN COSMETIC EMULSIONS. XIX, 1090

HENRY, Richard Warfield. SCINTILLATION STUDIES OF TERBIUM^{156} AND TERBIUM^{154}. XIX, 1099

HERSMAN, Marion Frank. I. DERIVATIVES OF P-PHENYLPHOSPHONAMIDIC AND THIOPHOSPHONAMIDIC ACIDS. II. RESOLUTION STUDIES OF DERIVATIVES OF P-PHENYLPHOSPHONAMIDIC ACIDS. XIX, 955

HERTEL, Robert Russell. THE DECLINE OF THE PAPERBOUND NOVEL IN AMERICA, 1890-1910. XIX, 1081

HERTLER, Walter Raymond. FORMATION OF δ-HALOAMINES AND CYCLIC AMINES BY THE FREE RADICAL CHAIN DECOMPOSITION OF N-HALOAMMONIUM IONS. PART I. MECHANISM AND SCOPE. PART II. SYNTHESIS OF DIHYDROCONESSINE. XIX, 956

HILDEBRANDT, Herbert William. A CRITICAL EDITION OF RICHARD SHERRY'S A TREATISE OF SCHEMES AND TROPES. XIX, 1138

HILL, Arthur B. MASS TRANSFER EFFICIENCIES IN BUBBLE-CAP DISTILLATION SYSTEMS. XIX, 1033

HOCKER, Robert Grant. DERIVATIVE POLAROGRAPHY OF D-GLUCOSE, D-GALACTOSE AND D-MANNOSE. XIX, 967

HOFFMAN, Horace E. APPROXIMATIONS TO THE ELECTRIC MICROFIELD DISTRIBUTION FUNCTION IN IONIZED GASES. XIX, 1093

HOLBROOK, Anthony. AN EXPLORATORY STUDY OF DIPHTHONG FORMANTS. XIX, 1138

HOLSHOUSER, Don Franklin. THE TIME ELEMENT IN PHOTOELECTRIC EMISSION. XIX, 1040

HUEBSCHMANN, Eugene Carl. X-RAY ABSORPTION EDGES OF Zn AND Cu IONS IN SOLUTIONS OF WATER AND ALCOHOL. XIX, 1093

HUFF, Lawrence. JOSEPH ADDISON TURNER: A STUDY IN THE CULTURE OF ANTE-BELLUM MIDDLE GEORGIA. XIX, 1072

HULET, Richard Earle. LEADERSHIP BEHAVIOR IN INDEPENDENT AND FRATERNITY HOUSES. XIX, 1015

HULSER, John Vincent. FACTORS OF RELIGION AND SOCIAL CLASS IN THE SUPPORT OF PUBLIC SCHOOLS. XIX, 989

HUSAINI, Syed Mahmoodulla. PHOSPHOLIPID AND CASEIN INTERACTIONS IN MILK. XIX, 919

IBEN, JR., Icko. PART I. HIGHER ORDER EFFECTS IN BETA DECAY. PART II. THE BETA-GAMMA CORRELATION AND TIME REVERSAL INVARIANCE. XIX, 1099

JACKSON, Curtis Rukes. ALTERNARIA LEAFSPOT DISEASE OF CUCURBITS. XIX, 940

JENNINGS, William Lamar. THE ECOLOGICAL DISTRIBUTION OF BATS IN FLORIDA. XIX, 1143

JOHNSON, Gordon Lee. KINETICS, STEREOCHEMISTRY, AND MECHANISM OF THE CHLORIDE ION EXCHANGE WITH CIS-DICHLORO-BIS-ETHYLENEDIAMINE-PLATINUM(IV) ION. XIX, 952

JOHNSON, John R. A NEW PHOTOMETRIC REFLECTANCE METHOD FOR THE DETERMINATION OF THE OPTICAL CONSTANTS OF CRYSTALS. XIX, 1096

JOHNSON, JR., Joseph Andrew. CHRISTOLOGY AND ATONEMENT IN THE FOURTH GOSPEL. XIX, 1130

JOHNSON, Richard M. A BIOGEOGRAPHIC STUDY OF THE HERPETOFAUNA OF EASTERN TENNESSEE. XIX, 1143

JONES, JR., Benjamin Angus. A STUDY OF THE EFFECT OF CRACK WIDTH AT TILE JOINTS ON SOIL MOVEMENT INTO DRAIN TILE LINES. XIX, 1038

JONES, James Donald. STUDIES ON IMPROVED NUTRITION DUE TO ANTIBIOTICS. XIX, 944

JORDAN, Harriet Patricia. THE LINCOLN-DOUGLAS DEBATES OF 1858: A PRESENTATION OF THE RHETORICAL SCENE AND SETTING WITH A PILOT FILM SCRIPT OF THE OTTAWA DEBATE. XIX, 1139

JOYNES, Mary Lu. STRUCTURAL ANALYSIS OF OLD ENGLISH METRICS. XIX, 1076

KALLIANOS, Andrew George. THE METABOLIC FATE OF QUERCETIN IN RATS. XIX, 944

KAY, Mortimer I. STRUCTURES OF POLYMORPHIC FORMS: I. THE CRYSTAL AND MOLECULAR STRUCTURE OF α-PIMELIC ACID. XIX, 967

KAZI, Afzal Muhammad. MINIMUM RESTRICTIONS ON ENERGY METHOD IN ELASTICITY. XIX, 1047

KEMMERLY, Jack Ellsworth. NONLINEAR DIFFERENTIATING FILTERS. XIX, 1040

KEMP, Thomas G. THE INFLUENCE OF IMMEDIATE AND DELAYED INFORMATION ON HUMAN MAZE LEARNING AND TRANSFER. XIX, 1109

KENNEDY, Joseph Patrick. THE BIOLOGY OF THE EASTERN FENCE LIZARD, SCELOPORUS UNDULATUS HYACINTHINUS. XIX, 1144

KENNINGTON, Mack Humpherys. THE EFFECT OF ADDING ANIMAL FAT TO PRACTICAL SWINE GROWING RATIONS IN VARIOUS CALORIE TO PROTEIN RATIOS. XIX, 923

KIGGINS, Edward M. SOME METABOLIC ACTIVITIES, NUTRITIONAL AND GASEOUS REQUIREMENTS OF VIBRIO FETUS. XIX, 935

KIMMICH, O. F. M., Paul Edward. JOHN MILTON'S TECHNICAL HANDLING OF THE LATIN ELEGY. XIX, 1078

KING, Robert Malcolm. THE INFLUENCE OF OXIDES ON THE WETTING OF METALS BY PORCELAIN ENAMEL GLASSES. XIX, 1033

KINTANAR, Roman Lucero. A STUDY OF TYPHOON MICROSEISMS. XIX, 1097

KIRBY, Kenneth William. COMPOSITION OF ALGINIC ACID AND THE PREPARATION AND PROPERTIES OF ALGINAMIDES. XIX, 945

KLEIN, LeRoy. THE ACTION OF COLLAGENASE ON NATIVE COLLAGEN. XIX, 945

KLINK, Rowland Dean. A SURVEY OF THE USES MADE OF COMMERCIAL TELEVISION PROGRAMS BY TEACHERS IN THE ELEMENTARY SCHOOLS OF INDIANA. XIX, 1029

KLOTZBERGER, Edward Lewis. THE GROWTH AND DEVELOPMENT OF STATE TEACHERS COLLEGE, NEW PALTZ, STATE UNIVERSITY OF NEW YORK WITH IMPLICATIONS OF EDUCATION IN THE STATE OF NEW YORK. XIX, 1009

KRAMER, John Paul. A STUDY OF MICROSPORIDIOSIS IN THE EUROPEAN CORN BORER, PYRAUSTA NUBILALIS (HÜBNER). XIX, 1144

KREBS, Robert Edward. THE EFFECTS OF EDUCATIONAL FILMS ON STUDENT PERCEPTIONS. XIX, 1030

KREISELMAN, Mariam J. THE CARIBBEAN FAMILY: A CASE STUDY IN MARTINIQUE. XIX, 930

AUTHOR INDEX

KRUEGER, Anne Osborn. AN EVALUATION OF SOME GROWTH THEORIES IN LIGHT OF UNITED STATES ECONOMIC EXPERIENCE, 1946-57. XIX, 983

KUO, Franklin. POLE-ZERO SENSITIVITY IN NETWORK FUNCTIONS. XIX, 1041

KUSHIBAB, Frank J. STUDIES RELATING TO THE Sn2' REACTIVITY OF THE t-BUTYL VINYL CARBINYL STRUCTURE. XIX, 956

KUSHNER, Harold Joseph. ON THE SELF ORGANIZING AUTOMATA. XIX, 1041

LEICHNER, Gene Howard. A STATISTICAL APPROACH TO THE TOLERANCE PROBLEM IN DESIGN. XIX, 1042

LENTINI, Eugene Alfred. VENTRICULAR OXYGEN CONSUMPTION AS INFLUENCED BY MYOCARDIAL FIBER LENGTH AND TENSION IN THE RAT. XIX, 1104

LEVENTHAL, David Edgar. EQUILIBRIUM DIALYSIS STUDIES OF PURINE AND PYRIMIDINE BINDING TO RABBIT MYOFIBRILS. XIX, 945

LIEBERMAN, Bernhardt. THE AUCTION VALUES OF UNCERTAIN OUTCOMES IN WIN AND LOSS TYPE SITUATIONS. XIX, 1110

LIGHTFOOT, Billy Bob. THE STATE DELEGATIONS IN THE CONGRESS OF THE UNITED STATES, 1789 - 1801 (VOLUMES I AND II). XIX, 1067

LINGER, Irving Oscar. THE ROLE OF CLEARING UNDER THE FEDERAL RESERVE SYSTEM. XIX, 981

LONDON, Sheldon A. A STUDY OF BACTERIOPHAGE VIII-113 SPECIFIC FOR FLAGELLATED SALMONELLAE XIX, 935

LONG, Sterling Krueger. STUDIES ON THE PHYSIOLOGY AND LIPIDS OF A THERMOPHILIC SPOREFORMING BACTERIUM. XIX, 936

LUCAR, Janet. A STUDY OF ELEMENTARY TEACHERS' ATTITUDES TOWARD CURRICULAR PATTERNS, METHODS, AND MATERIALS IN GEOGRAPHY AND HISTORY IN THE STATE OF LOUISIANA. XIX, 989

LUDWIG, Jay Ferris. McVICKER'S THEATRE, 1857-1896. XIX, 1140

LYLE, Mary Frances. PARTICIPATION OF OLDER MEMBERS IN 4-H CLUBS IN SELECTED COUNTIES IN SOUTH DAKOTA. XIX, 1069

LYNN, Robert Athan. WHOLESALING USED AUTOMOBILES. XIX, 977

MAC VEAN, Donald Sidney. A STUDY OF CURRICULUM LABORATORIES IN MIDWESTERN TEACHER-TRAINING INSTITUTIONS. XIX, 1082

MAHER, Robert Francis. A CASE STUDY OF CULTURE CHANGE IN THE TERRITORY OF PAPUA. XIX, 931

MALONE, Robert Lincoln. A CONFIGURAL VERSUS THE STANDARD METHOD OF SCORING THE STRONG VOCATIONAL INTEREST BLANK. XIX, 1110

MANKIN, Charles John. STRATIGRAPHY AND SEDIMENTARY PETROLOGY OF JURASSIC AND PRE-GRANEROS CRETACEOUS ROCKS, NORTHEASTERN NEW MEXICO. XIX, 1055

MANLEY, William Tanner. CONSUMERS' USE OF AND OPINIONS ABOUT FLORIDA AVOCADOS. XIX, 920

MARKOWSKI, Stanley Leonard. THE EVALUATION OF TABLET LUBRICANTS USING A CONVENTIONAL TYPE TABLET MACHINE INSTRUMENTED WITH STRAIN EQUIPMENT. XIX, 1091

MARTIN, Michael McCulloch. I. POLYMERIC BASIC BERYLLIUM CARBOXYLATES. II. POLYMERIC PHTHALOCYANINES. XIX, 957

MARTINEZ, Juan N. ATTITUDES AND CONCEPTS OF PUERTO RICAN PROFESSIONALS REGARDING MENTAL ILLNESS: AN EXPLORATORY STUDY OF A GROUP OF PUERTO RICAN PROFESSIONALS; MEDICAL DOCTORS, SOCIAL WORKERS, NURSES, TEACHERS, AND RELIGIOUS WORKERS. XIX, 1111

MATNEY, Thomas Stull. STUDIES ON THE ORIGIN OF INDUCED MUTANTS IN BACTERIA. XIX, 936

MAYE, Arthur L. A HANDBOOK FOR AREA DIRECTORS OF CHRISTIAN EDUCATION IN THE AMERICAN BAPTIST CONVENTION. (BOOKS I AND II). XIX, 1130

MAYEDA, Wataru. THE APPLICATION OF MATHEMATICAL LOGIC TO NETWORK THEORY. XIX, 1042

MAYFIELD, Leonard B. A STUDY OF OREGON'S PUBLIC SCHOOL TRANSPORTATION PROGRAM. XIX, 990

McCALDIN, Roy O. CONTROLLED ATMOSPHERES FOR AIR POLLUTION STUDIES. XIX, 1048

McCOLSKEY, Ann Shedden. A FACTOR ANALYTIC STUDY OF PSYCHIATRIC TYPES. XIX, 1116

McCORMICK, Donald Bruce. THE METABOLISM OF SOME CARBOHYDRATES METABOLICALLY RELATED TO L-XYLULOSE. XIX, 946

McDANIEL, Ivan Noel. BIONOMICS OF THE BROWN WOODS MOSQUITO, AEDES STIMULANS (WALKER) (DIPTERA, CULICIDAE). XIX, 1145

MCDERMOTT, James Kenneth. PUBLIC DECISION MAKING IN ECONOMIC DEVELOPMENT IN A SOUTHERN INDIANA COUNTY. XIX, 1135

McDOWELL, Arnold Albert. TRANSFER BY NORMAL AND CHRONIC WHOLE-BODY IRRADIATED MONKEYS OF A SINGLE LEARNED DISCRIMINATION ALONG A PERIPHERAL CUE GRADIENT. XIX, 1124

MC FALL, Inez E. THE CATHODIC REDUCTION OF VANADIUM (V) AT A MERCURY COVERED ELECTRODE. XIX, 968

McGRANAGHAN, Francis Richard. THE OXIDATION OF SECONDARY ALCOHOLS WITH CHROMIC ACID, NITROGEN DIOXIDE AND TERT.-BUTYL HYPOCHLORITE. XIX, 957

MC GRAW, JR., Arthur Garfield. EXTENT, NATURE, PURPOSES, STRUCTURE, AND OPERATIONAL PRACTICES OF CITIZEN COMMITTEES IN EDUCATION IN WISCONSIN. XIX, 1003

McKINNEY, William Mark. GEOGRAPHIC ASPECTS OF HOSPITAL PLANNING. XIX, 1051

McLAUGHLIN, Charles Albert. A TAXONOMIC STUDY OF THE POCKET GOPHERS, GENUS GEOMYS, OF THE CENTRAL UNITED STATES. XIX, 1145

McMURRAY, Loren Robert. HARMONIC HYPERVARIABLES. XIX, 1086

MEACHAM, William Ross. FACTORS AFFECTING GENE EXCHANGE BETWEEN TWO ALLOPATRIC POPULATIONS IN THE BUFO WOODHOUSEI COMPLEX. XIX, 1146

MEANS, Ernest Elmer. JUDICIAL INDEPENDENCE AND THE SUMMARY CONTEMPT POWER OVER PUBLICATIONS. XIX, 1106

MELVIN, Georgia-Lee Virginia. PERSONALITY AND GROUP STATUS IN ADOLESCENTS. XIX, 1134

MENCHER, Joan P. CHILD REARING AND FAMILY ORGANIZATION AMONG PUERTO RICANS IN EASTVILLE: EL BARRIO DE NUEVA YORK. XIX, 931

MENZEL, JR., Emil Wolfgang. VARIABILITY OF BEHAVIOR IN PROBLEMS OF DIFFERENT TYPES AND DIFFERENT LEVELS OF DIFFICULTY. XIX, 1125

METZGER, Paul Lyman. AN INVESTIGATION OF SOME CORRELATES OF VOCATIONAL INTEREST SIMILARITY BETWEEN FATHERS AND SONS. XIX, 1116

MILLEA, Michael Francis. EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN SILICON. XIX, 1094

MILLIFF, John Henry. A STUDY OF THE NUCLEI OF THE MEDULLA ABLONGATA, PONS, MESENCEPHALON, AND DIENCEPHALON OF THE BRAIN OF THE DOMESTIC TURKEY, MELEAGRIS GALLOPAVO. XIX, 929

MIXON, Forest Orion. BOUNDARY LAYER TECHNIQUES APPLIED TO LIQUID THERMAL DIFFUSION. XIX, 1034

MIZELL, Sherwin. THE EFFECT OF GLUCOSE AND ITP ON THE SEASONAL VARIATION OF GASTRIC ACID SECRETION IN RANA PIPIENS. XIX, 1105

MOGHRABI, Hashem Mohamed. PHYSICAL AND CHEMICAL CHANGES DURING THE RIPENING OF TOMATOES AS AFFECTED BY TEMPERATURE. XIX, 928

MONKMAN, John Alexander. THE RELATIONSHIP BETWEEN CHILDREN'S ADJUSTMENT AND PARENTAL ACCEPTANCE. XIX, 1117

MOORE, Erin Colleen. EFFECTS OF CERTAIN PURINE INHIBITORS IN NORMAL AND NEOPLASTIC TISSUES. XIX, 947

MORGAN, Carl William. SURFACE RUNOFF IN THE GULF COAST AREA IN RELATION TO SOLAR ACTIVITY. XIX, 1038

MORTLOCK, Robert Paul. CARBON DIOXIDE ACTIVATION IN THE PYRUVATE CLASTIC SYSTEM OF CLOSTRIDIUM BUTYRICUM. XIX, 937

MOTZ, Kaye Lamarr. THE ACETYLATION OF 1, 1'-DIMETHYLFERROCENE. XIX, 958

MUKAI, Terumi. SINGLE GENE HETEROSIS ASSOCIATED WITH A SECOND CHROMOSOME RECESSIVE LETHAL IN DROSOPHILA MELANOGASTER. XIX, 939

MURPHY, John Joseph. INVESTIGATIONS INTO THE THEORY OF HIGH ENERGY ACCELERATORS. XIX, 1094

NACHTMANN, Francis Weldon. A HISTORY OF STUDIES OF THE OLD FRENCH WILLIAM CYCLE. XIX, 1079

NALL, Julian Clark. AN IRON-FREE, DOUBLE-FOCUSING, BETA-RAY SPECTROMETER AND THE ANALYSIS OF THE L-AUGER SPECTRUM OF GOLD-199---MERCURY-199. XIX, 1100

NASH, Robert A. THE HALF-WAVE POTENTIALS OF ANTIOXIDANTS. XIX, 964

NEILSON, James Warren. THE SENATORIAL CAREER OF SHELBY MOORE CULLOM. XIX, 1067

NELSON, Calvin Clayton. A COMPARISON OF RETARDED AND NORMAL CHILDREN WITH RESPECT TO ALEXANDER'S "F" FACTOR. XIX, 1015

NELSON, James Andrew. RHEOLOGICAL PROPERTIES OF THE CLAY-WATER SYSTEM UNDER PRESSURE. XIX, 1034

NELSON, Karl E. CERAMIC AND DIELECTRIC PROPERTIES OF LEAD METANIOBATE ELECTRICAL CERAMICS. XIX, 1034

NESTICO, Ralph Frank. A COMPARATIVE STUDY OF SELECTED ASPECTS OF VACATIONAL GUIDANCE IN FRANCE AND THE UNITED STATES. XIX, 991

NEWBORN, JR., George Earl. THERMAL DEGRADATION OF CARBAMATES OF METHYLENEBIS (4-PHENYL ISOCYANATE). XIX, 959

NEWBURG, Edward Allen. POTENTIAL REPRESENTATIONS IN INTEGRAL EQUATIONS. XIX, 1087

NEWELL, Marjorie Pauline. COMPOUNDS FOR METABOLISM STUDIES: RADIOACTIVE AROMATIC AMINES AND THEIR POSSIBLE DETOXICANTS. XIX, 947

NULL, George D. STUDIES IN THE BROMINATION AND OXIDATION OF NORBORNANE CARBOXYLIC ACIDS. XIX, 959

AUTHOR INDEX

O'CONNELL, Walter Edward. A STUDY OF THE ADAPTIVE FUNCTIONS OF WIT AND HUMOR. XIX, 1126

OLSEN, JR., Hans Christian. A COMPARISON OF THE FRESHMAN ELEMENTARY EDUCATION POPULATIONS AND SELECTED FACTORS ASSOCIATED WITH THEIR ENROLLMENT AT THE UNIVERSITY OF ILLINOIS AND EASTERN ILLINOIS STATE COLLEGE. XIX, 1022

ORR, Marcus Wayne. THE RENAISSANCE AND THE RISE OF MODERN SOCIAL THOUGHT. XIX, 1135

O'SHEA, Christopher John. THE MERCURY PHOTOSENSITIZED HOMOMOLECULAR EXCHANGE OF OXYGEN. XIX, 952

OVERALL, John Ernest. A STATISTICAL MODEL FOR THE PREDICTION OF HUMAN DECISION BEHAVIOR. XIX, 1126

PANKEY, John Willard. ELECTRODE POTENTIALS IN FUSED LITHIUM CHLORIDE-POTASSIUM CHLORIDE EUTECTIC. BEHAVIOR OF HALOGEN, IRON AND VANADIUM ELECTRODES. XIX, 968

PAREIS, Egbert Nelson. INKBLOT PERCEPTION AND PERSONALITY: AN EXPERIMENTAL DEPARTURE FROM THE RORSCHACH TEST. XIX, 1118

PARSONS, Burke Adrian. BRITISH TRADE CYCLES AND AMERICAN BANK CREDIT: SOME ASPECTS OF ECONOMIC FLUCTUATIONS IN THE UNITED STATES, 1815-1840. XIX, 974

PASCALE, Donald A. A STUDY OF THE TERNARY SYSTEM FERRIC CHLORIDE-WATER-DIOXANE AT 25°C. XIX, 968

PEACOCK, Leslie Clark. POLICIES AND OPERATIONS OF THE INTERNATIONAL MONETARY FUND: 1947-1956. XIX, 982

PEREIRA, Joseph Nunes. THE NUTRITION AND PHYSIOLOGY OF PSEUDOMONAS FRAGI. XIX, 937

PERKINS, Edward George. THE CHEMISTRY OF A THERMALLY OXIDIZED OIL. XIX, 959

PIERRON, Emile Desire. STUDY ON THE PLASTIC PROPERTIES OF COAL. XIX, 941

PLATT, Herbert A. METAL COMPLEXES OF TETRACAINE HYDROCHLORIDE AND RELATED LOCAL ANESTHETICS. XIX, 1091

POLIVKA, Raymond Peter. A GENERALIZATION OF SINGULAR INTEGRAL EQUATIONS WITH COMPLEX KERNELS. XIX, 1087

POLKOWSKI, Lawrence Benjamin. FACTORS INFLUENCING FROTHING IN SEWAGE TREATMENT. XIX, 1049

POPHAM, W. James. RELATIONSHIPS BETWEEN OUT-OF-SCHOOL ACTIVITIES OF TEACHERS AND THEIR ATTITUDES TOWARD PUPIL-TEACHER RELATIONS. XIX, 992

POTTER, Lawrence Merle. EVALUATION OF ALPHA CELLULOSE FOR ITS METABOLIZABLE AND PRODUCTIVE ENERGY AND A COMPARISON OF METHODS FOR DETERMINING METABOLIZABLE ENERGY IN THE CHICK. XIX, 923

PRICE, II, Robert Preston. RELIGIOUS ENCOUNTER IN THE THOUGHT OF MARTIN BUBER AND OF JEREMIAH. XIX, 1131

PROPHET, Wallace W. THE EFFECT OF VALUE ON THE PERCEPTION OF DISTANCE. XIX, 1127

PURDOM, JR., Glen A. COMPARISON OF PERFORMANCE OF COMPETENT AND INCOMPETENT READERS IN A STATE TRAINING SCHOOL FOR DELINQUENT BOYS ON THE WAIS AND THE ROSENZWEIG P-F STUDY. XIX, 1016

QUAY, Herbert Callister. THE EFFECT OF VERBAL REINFORCEMENT ON THE RECALL OF EARLY MEMORIES. XIX, 1118

RAFFERTY, Nancy Schwarz. A STUDY OF THE RELATIONSHIP BETWEEN THE PRONEPHROS AND THE HAPLOID SYNDROME IN FROG LARVAE. XIX, 1146

RAO, Chintamani Nagesa Ramachandra. MOLECULAR STRUCTURE INVESTIGATIONS BY ELECTRON DIFFRACTION. XIX, 968

REEVES, Clyde Elwood. THE DEBATES ON THE WAR OF 1812: PARLIAMENT AND CONGRESS COMPARED. XIX, 1140

REID, Lawrence Leon. A STUDY OF CEREBRAL PALSY IN TEXAS. XIX, 1017

REILLY, Agnes L. AN ANALYTICAL STUDY OF THE NEW YORK STATE RETIRED TEACHER WITH IMPLICATIONS FOR PRERETIREMENT COUNSELING. XIX, 1004

RETTKE, Gordon Howard. THE EFFECT OF SYLLABIFIED PRINT ON FOUR ASPECTS OF READING. XIX, 1017

RICHARDSON, Keith Erwin. THE METABOLISM OF INOSITOL. XIX, 948

RICKETTS, Bernard Gordon. RECOVERY AND SUBGRAIN GROWTH IN COLD-ROLLED SINGLE CRYSTALS OF ALUMINUM. XIX, 1048

RIOUX, Robert Lester. GEOLOGY OF THE SPENCE-KANE AREA, BIG HORN COUNTY, WYOMING. XIX, 1055

ROBBINS, Ralph Compton. THE OCCURRENCE AND ISOLATION OF AN UNIDENTIFIED VOLATILE COMPOUND ASSOCIATED WITH ERYTHROCYTES. XIX, 948

RODGERS, Glen Morris. OFFICIAL ENGLISH MARITIME EXPLORATIONS 1660-1780: A STUDY OF THE BEGINNINGS OF SCIENTIFIC EXPEDITIONS. XIX, 1063

ROLLERI, Vincent A. STUDIES IN BICYCLIC BROMOKETONES. XIX, 960

ROSENSTEIN, Alvin Jay. THE EFFECTS OF STRESS ON SERIAL LEARNING. XIX, 1127

ROTHWELL, JR., Jack C. THE CONSERVATION PROGRAM OF THE RAILROAD COMMISSION AND THE STRUCTURE OF CRUDE OIL PRICES IN TEXAS. XIX, 978

ROUX, JR., Wilfred Francois. STRATIGRAPHY OF UPPER MIDWAY AND LOWER WILCOX GROUPS, WEST-CENTRAL ALABAMA AND EAST-CENTRAL MISSISSIPPI. XIX, 1056

RUGGIERO, John Salvator. AN EVALUATION OF THE ABSORBTION OF RADIOACTIVE SODIUM IODIDE FROM VARIOUS OINTMENT BASES BY MEANS OF A CHICK EMBRYO TECHNIQUE. XIX, 1061

RUTLEDGE, Robert Locke. RADIO-FREQUENCY SPECTROSCOPY. A. ELECTRON SPIN RESONANCE IN FREE RADICALS. B. NUCLEAR MAGNETIC RESONANCE IN HETEROCYCLIC COMPOUNDS. XIX, 969

RYAN, William. CAPACITY FOR MUTUAL DEPENDENCE AND INVOLVEMENT IN GROUP PSYCHOTHERAPY. XIX, 1119

SAGERS, Richard Douglas. GLYCINE CLEAVAGE AND ONE-CARBON TRANSFER IN ACETATE FORMATION BY DIPLOCOCCUS GLYCINOPHILUS AND CLOSTRIDIUM ACIDI-URICI. XIX, 938

SAMS, III, Burnett Henry. FINITE GROUPS OF AUTOMORPHISMS OF ALGEBRAIC FUNCTION FIELDS. XIX, 1088

SARGENT, Leslie William. SOME PROJECTIVE MEASUREMENTS OF THE EFFECT OF TELEVISION ON THE VALUE STRUCTURE OF THE ELEMENTARY SCHOOL CHILD. XIX, 1128

SARTORELLI, Alan Clayton. ACTION OF PURINE ANTIMETABOLITES ON NEOPLASTIC TISSUE. XIX, 949

SAXBERG, Börje Osvald. UNITED STATES GOVERNMENTAL INVESTMENT GUARANTEE PROGRAM FOR PRIVATE FOREIGN DIRECT INVESTMENTS, DEVELOPMENT AND APPLICATION 1946-1954. XIX, 978

SCALORA, Frank Salvatore. ABSTRACT MARTINGALE CONVERGENCE THEOREMS. XIX, 1089

SCHAR, Wayne Curtis. THE REACTION OF DECABORANE WITH SUBSTITUTED ALCOHOLS. XIX, 960

SCHERRER, Robert Allan. STUDIES IN THE SESQUITERPENE FIELD: THE SYNTHESIS OF α-SANTALENE AND AN APPROACH TO THE SYNTHESIS OF LONGIFOLENE. XIX, 960

SCHOEN, Alan Hugh. SELF-DIFFUSION IN ALPHA SOLID SOLUTIONS OF SILVER-CADMIUM AND SILVER-INDIUM. XIX, 1100

SCHOTT, Hans. THE TERNARY SYSTEMS COBALT CHLORIDE-DIOXANE-WATER AND NICKEL CHLORIDE-DIOXANE-WATER. XIX, 969

SCHROEDER, Paul Walter. METTERNICH'S DIPLOMACY AT ITS ZENITH: AUSTRIA AND THE CONGRESSES OF TROPPAU, LAIBACH, AND VERONA. XIX, 1068

SCOTT, Alan Johnson. LATE DEVONIAN AND EARLY MISSISSIPPIAN CONODONT FAUNAS OF THE UPPER MISSISSIPPI VALLEY. XIX, 1056

SELLERS, James Earl. THE CHURCH AND MASS COMMUNICATION. XIX, 1132

SELLERS, JR., John Paul. EXPERIMENTAL AND THEORETICAL STUDY OF THE APPLICATION OF FILM-COOLING TO A CYLINDRICAL ROCKET THRUST CHAMBER. XIX, 1046

SHELLEY, Austin Linn. AN INVESTIGATION OF TIME-CONSTANT VALUES IN THE DESIGN OF TWO-PHASE SERVOMOTORS. XIX, 1043

SHEPHERD, Thomas Hugh. POLYMERIZATION REACTIONS OF ITACONIC ACID AND ITS DERIVATIVES. XIX, 961

SHERTZER, Bruce E. RECOMMENDED GUIDANCE STANDARDS FOR COMMISSIONED SECONDARY SCHOOLS OF INDIANA. XIX, 1005

SHERWIN, Wilma. THE RHETORICAL STRUCTURE OF THE ENGLISH SERMON IN THE SIXTEENTH CENTURY. XIX, 1072

SHIGLEY, E. Harold. AN EVALUATION OF STUDENT PERSONNEL SERVICES AT MARION COLLEGE. XIX, 1018

SHUTTS, William Holland. CHARACTERISTICS OF FLOW AROUND BLUNTED CONES WITH AXIAL SYMMETRY AT SUPERSONIC SPEEDS. XIX, 1031

SIMASATHIEN, Panas. THE BUDGETARY CONTROL OF FEDERAL EXPENDITURES. XIX, 979

SIMPSON, Charles Albert. THE COORDINATION OF CARBOXYLIC ACIDS WITH OLATED CHROMIC CHLORIDE. XIX, 970

SIMPSON, William Harold. A STUDY OF SOME FACTORS IN THE BENDER GESTALT REPRODUCTIONS OF NORMAL AND DISTURBED CHILDREN. XIX, 1120

SINCLAIR, John Ramsay. THE THERMODYNAMICS OF SODIUM AMIDE AND SELECTED BORON COMPOUNDS IN LIQUID AMMONIA XIX, 970

SKINNER, John William. AGE-MATE ASSESSMENTS IN EARLY ADOLESCENCE. XIX, 1018

SLYKHOUSE, Thomas Edward. THE EFFECT OF PRESSURE ON SOLID STATE SPECTRA. XIX, 1094

SMALL, Ray. A CRITICAL EDITION OF DIARMUID AND GRANIA, BY WILLIAM BUTLER YEATS AND GEORGE MOORE. XIX, 1073

AUTHOR INDEX

SMITH, Aaron. DISCREPANCY IN THE MEANING OF SELF IN A MULTI-LEVEL PERSONALITY SYSTEM AND EMOTIONAL DISTURBANCE. XIX, 1120

SMITH, Gordon Meade. THE SCATTERING OF METASTABLE HELIUM ATOMS IN HELIUM, NEON, AND ARGON. XIX, 972

SMITH, Morris Eugene. A HISTORY OF CALIFORNIA STATE POLY-TECHNIC COLLEGE, THE FIRST FIFTY YEARS, 1901-1951. XIX, 992

SMITH, JR., Paul Milton. PERSONALITY CHARACTERISTICS OF RURAL AND URBAN SOUTHERN NEGRO CHILDREN. XIX, 1019

SOSIN, Gene. CHILDREN'S THEATER AND DRAMA IN THE SOVIET UNION (1917-1953). XIX, 1074

SPAIN, James Maurice. A STUDY OF THE STRUCTURES AND PROPERTIES OF CERTAIN TETRA-ALKYL AMMONIUM MONTMORILLONITES. XIX, 928

SPIVA, JR., George Anthony. ECONOMIC DEVELOPMENT IN MODERN GREECE: A STUDY OF INSTITUTIONAL RESISTANCES. XIX, 974

STABA, Emil John. MANOMETRIC STUDY OF CLAVICEPS PURPUREA (FRIES) TULASNE AND CLAVICEPS LITORALIS KAWATANI. XIX, 1061

STAPLEY JR., Howard A. A STUDY OF THE IDENTIFICATION, LOCAL PRE-SERVICE TRAINING, SELECTION, AND ORIENTATION OF ELEMENTARY SCHOOL PRINCIPALS IN SELECTED INDIANA SCHOOLS. XIX, 1006

STEPHENS, Robert Oren. THE ESCAPE MOTIF IN THE WORKS OF ERNEST HEMINGWAY. XIX, 1079

STINCHFIELD, Raymond Dana. THE PUBLIC SCHOOL SUPERINTENDENCY IN THE STATE OF MAINE. XIX, 1006

STROSS, Raymond George. EXPERIMENTALLY INDUCED CHANGES IN LAKES. a) ENVIRONMENTAL CHANGES FOLLOWING LIME-APPLICATION TO STAINED LAKES. b) CHANGES IN THE PLANKTONIC CRUSTACEA FOLLOWING THE INTRODUCTION OF TROUT TO A FISH-FREE LAKE. XIX, 1147

SVOBODA, Glenn Richard. SEPARATION AND INVESTIGATION OF THE MINOR ALKALOIDAL CONSTITUENTS OF SCHOENOCAULEN OFFICINALE. XIX, 964

SWANK, Donald. AN ANALYSIS OF SCHOLASTIC ACHIEVEMENT OF TRANSFER STUDENTS FROM PURDUE EXTENSION CENTERS. XIX, 993

TANG, Yau-Chien. THE NUCLEAR STRUCTURE EFFECT ON THE ELECTRIC K-CONVERSION COEFFICIENTS. XIX, 1101

TEHON, Stephen Whittier. PIEZOELECTRIC AND MAGNETOSTRICTIVE TRANSDUCERS. XIX, 1043

TERRY, Patricia Ann. LE LAI DE L'OMBRE, BY JEAN RENART. XIX, 1074

THOMA, Edward Charles. A STUDY OF THE PURDUE UNIVERSITY ENGINEERING GRADUATE. XIX, 994

THOMPSON, Clifford Francis. I. CHAIN TRANSFER CONSTANTS OF VINYL ESTERS. II. ALKYL DITHIOACRYLATES. XIX, 962

THOMPSON, Willard Linn. SELF-REGULATION IN ADVERTISING. XIX, 1070

THORSELL, Bernard Alan. AN EMPIRICAL EXPLORATION OF THE PROBLEM OF MEASURING HUMAN VALUES: A SOCIOLOGICAL STUDY. XIX, 1136

TRAUTMAN, Jack Carl. HEAT-INDUCED COMPLEX FORMATION IN MILK. XIX, 924

TREBING, Harry Martin. PROJECT EVALUATION TECHNIQUES FOR FEDERAL MULTIPLE PURPOSE PROJECTS. XIX, 975

TREYBIG, Leon Bruce. CONCERNING LOCALLY PERIPHERALLY SEPARABLE SPACES. XIX, 1089

TRIPLETT, M. Evelyn. A SURVEY OF THE PROFESSIONAL QUALIFICATIONS, RESPONSIBILITIES, INADEQUACIES, AND NEEDS OF WOMEN PHYSICAL EDUCATION TEACHERS IN KANSAS SECONDARY SCHOOLS WITH IMPLICATIONS FOR TEACHER EDUCATION. XIX, 1022

TUCKER, Don Harrell. ABSOLUTELY CONTINUOUS SOLUTIONS OF $u_{xy} = f(x, y, u, u_x, u_y)$. XIX, 1089

TUCKER, JR., Ronald Forest. A PARAMAGNETIC RESONANCE STUDY OF COPPER DOPED SILVER CHLORIDE. XIX, 1095

TURNER, Mildred White. A COMPARISON OF THE SOCIAL STATUS OF MENTALLY RETARDED CHILDREN ENROLLED IN SPECIAL CLASSES. XIX, 1020

TUTHILL, Dean Fanning. SELECTION AND COMPARISON OF OPTIMUM ORGANIZATIONS FOR FARMS IN THE LINCOLN AREA OF SOUTHERN ILLINOIS WITH EMPHASIS ON DAIRYING. XIX, 921

UNDERWOOD, Harold Wayne. AN INVESTIGATION OF THE VALIDITY OF HYPNOTICALLY INDUCED VISUAL HALLUCINATIONS. XIX, 1128

VALENTA, Milton William. EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN GERMANIUM. XIX, 1095

VANAPRUK, Prachuab. PROBABILITY OF SPARKOVER OF SMALL GAPS. XIX, 1044

VAN GELDER, Richard George. A TAXONOMIC REVISION OF THE SPOTTED SKUNKS (GENUS SPILOGALE). XIX, 1147

VAN HEYNINGEN, Roger Steven. TRANSIENT PHOTOCONDUCTIVITY IN SILVER CHLORIDE AT LOW TEMPERATURES. XIX, 1096

VASSALLO, Donald Arthur. AUTOMATIC DERIVATIVE POTENTIOMETRIC AND SPECTROPHOTOMETRIC TITRATIONS IN NON-AQUEOUS SOLVENTS. XIX, 941

VEST, Robert Duval. POLYMERIZATION REACTIONS OF NON-CONJUGATED DIOLEFINS. XIX, 962

VOOK, Frederick Ludwig. LENGTH AND RESISTIVITY CHANGES OF GERMANIUM UPON LOW TEMPERATURE DEUTERON IRRADIATION AND ANNEALING. XIX, 1096

WAIBLER, Paul John. NATURAL-CONVECTION HEAT TRANSFER WITH WATER AT HIGH GRASHOF NUMBERS. XIX, 1046

WALDRON, John Francis. RECONNAISSANCE GEOLOGY AND GROUND WATER STUDY OF A PART OF SOCORRO COUNTY, NEW MEXICO. XIX, 1057

WALGENBACH, Paul Henry. PERIODICITY AND THE PROVISION FOR FEDERAL INCOME TAX. XIX, 980

WALPER, Jack Louis. GEOLOGY OF THE COBAN-PURULHA AREA, ALTA VERAPAZ, GUATEMALA. XIX, 1057

WARD III, Benjamin Quinn. OXIDATIVE DEGRADATION PRODUCTS OF GLUCOSE AND CERTAIN ASPECTS OF THE CULTIVATION OF BACILLUS STEAROTHERMOPHILUS. XIX, 938

WATSON, Thomas Lee. A CRITICAL EDITION OF SELECTED LYRICS OF WILLIAM BUTLER YEATS. XIX, 1080

WEATHERS, William A. A COMPARISON OF TRANSFER AND NON-TRANSFER PUPILS IN THE PETERSBURG, INDIANA, HIGH SCHOOL. XIX, 994

WEAVER, Lynn Edward. ANALYSIS AND DESIGN OF RELAY TYPE SERVOMECHANISMS WITH DEAD TIME AND SAMPLING. XIX, 1044

WEAVER, William Michael. A STUDY OF THE REACTION OF ALKYL HALIDES WITH ALKALI NITRITES IN DIMETHYLFORMAMIDE. XIX, 963

WEINER, Bluma Beryl. HAWAII'S PUBLIC SCHOOL PROGRAM FOR MENTALLY RETARDED CHILDREN. XIX, 1007

WELKER, Robert Louis. EVELYN SCOTT: A LITERARY BIOGRAPHY. XIX, 1080

WELLS, James Howard. CONCERNING THE HAUSDORFF INCLUSION PROBLEM. XIX, 1089

WERT, Newell John. THE ROLE OF NORMS IN AMERICAN CATHOLIC SOCIOLOGICAL WRITING. XIX, 1136

WESSELHOFT, Robert Dale. THE RATE OF HYDROCHLORINATION OF ACETYLENE IN A FIXED CATALYST BED. XIX, 1035

WEST, James Thomas. AN INVESTIGATION OF THE CONSTRUCTS "EFFECTIVE INTELLIGENCE" AND "SOCIAL COMPETENCE" WITH THE COPPLE SENTENCE COMPLETION TEST UTILIZING A SCHOOL OF SOCIAL WORK POPULATION. XIX, 1121

WEST, Sherlie Hill. PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF 2, 4-DICHLOROPHENOXYACETIC ACID ON CELLULAR METABOLISM IN PLANTS. XIX, 929

WHITTAKER, James Oliver. THE EFFECTS OF EXPERIMENTALLY INTRODUCED ANCHORAGES UPON JUDGMENTS IN THE AUTOKINETIC SITUATION. XIX, 1111

WILCOX, Everett Elliott. CHARACTERISTICS, TRAINING, AND PERFORMANCE OF HOUSEPARENTS IN RESIDENTIAL SCHOOLS FOR THE BLIND. XIX, 1008

WILDER, Harry Sheridan. IMPROVEMENT IN COLLEGE TEACHING THROUGH MORE EFFECTIVE INTERPRETATION OF LANGUAGE (VOLUMES I AND II). XIX, 995

WILLIAMS, Raymond Edmund. THE MEASUREMENT AND PREDICTION OF COOPERATING TEACHER EFFECTIVENESS IN MUSIC TEACHER EDUCATION. XIX, 1023

WILLSON, Dan Leroy. A SURVEY OF THE SOIL ALGAE OF TWO VEGETATION TYPES IN CENTRAL OKLAHOMA. XIX, 940

WILSON, Leonard Gilchrist. THEORIES OF RESPIRATION IN THE SEVENTEENTH CENTURY. XIX, 1064

WILSON, Robert Charles. DEVELOPMENT OF CERAMIC USES FOR NEPHELINE SYENITE TAILINGS. XIX, 1036

WINSBERG, Morton D. THE ISLE OF PINES, CUBA: A GEOGRAPHIC INTERPRETATION. XIX, 1052

WITTERHOLT, Vincent Gerard. THE PREPARATION AND PROPERTIES OF FLUORINATED EPOXIDES. XIX, 963

WITTRY, Warren Lee. ARCHEOLOGICAL STUDIES OF FIVE WISCONSIN ROCKSHELTERS. XIX, 932

WRIGHT, JR., David Jay. TIME ESTIMATION MEASUREMENTS AND SCHIZOPHRENIA. XIX, 1121

YANG, Chao-Hwa. A STUDY OF CERTAIN BLUE-FLUORESCENT POLYPHENOLS IN TOBACCO LEAVES, FLOWERS AND CIGARETTE SMOKE. XIX, 949

ZAKI, Elsayed Gamal. THE POSSIBLE ROLE OF ADULT EDUCATION IN DEVELOPING THE EGYPTIAN RURAL COMMUNITIES. XIX, 1008

ZELLAR, Leonard Eugene. CONRAD'S USE OF EXTRA-NARRATIVE DEVICES TO EXTEND THEME. XIX, 1075

ZIMMERMAN, Donald Wilson. SUSTAINED PERFORMANCE BASED ON SECONDARY REINFORCEMENT: AN IMPROVED METHOD WITH ADDED CONTROLS. XIX, 1129

DISSERTATION ABSTRACTS

Volume XIX, No. 6

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